THE JOURNAL
OF THE
MINISTRY OF AGRICULTURE

Vol. XXX. No. 2.

MAY, 1923.

NOTES FOR THE MONTH.

Agricultural Policy of the Government.

1.—THE following statement with regard to the decisions of the Government as to the Report of the Tribunal of Economists was issued by the Minister of Agriculture on 11th April:—

In view of the short time since the Report was issued and the importance, financial and otherwise, of the questions involved the Government are not prepared to make any comprehensive statement at the present time.

With regard to railway rates the Government are of the opinion that the Railway Companies are in a position to reduce rates drastically. The remedy, however, lies in the hands of the industry itself, which can make an application to the Railway Rates Tribunal established by Parliament for such cases. In this connection meetings between the parties are being arranged, and the Ministry of Agriculture has expressed its willingness to give any assistance in its power.

With regard to hops the Government does not adopt the recommendations of the Tribunal. A little time will be necessary to ascertain what will be the probable future consumption of beer. The present control will continue till 1925. The Government recognises the claims of the hop-growers and before the expiration of the control will deal with the question.

With regard to local rates it has been decided that the Road Fund surplus, amounting probably to over £1,250,000, should be devoted to relief of rates for the upkeep of rural roads. The Government also intends, pending proposals for dealing with the whole rates question, to introduce a bill this Session to reduce the assessment of agricultural land from one-half to one-quarter, making good the difference by an Exchequer grant. This would be in addition to the proposal as to the Road Fund.

(18657). P.6./R 1. 9,250. 5/23. M. & S.

2.—A further statement was made to representatives of the Press by the Minister on 17th April. Sir Robert Sanders said that in the first place the Government proposed to hand over from the surplus of the Road Fund a sum of between £1,250,000 and £1,500,000 for the relief of the rates for the upkeep of rural roads. In addition the Government intend, pending proposals for dealing with the whole rating question, to introduce a Bill this Session to reduce the assessment of agricultural land for rates from one-half to one-quarter, making good the deficiency by an Exchequer grant. This, the Minister said, is the biggest concession to agriculture for a generation. It means that on an assessment of £100, with a rate of 11s. 6d. in the pound, a farmer will receive a relief of £14 7s. 6d. The total amount for England and Wales that will be covered by this Exchequer grant is £2,750,000, which, together with the grant of £1,300,000 which is still being paid under the Agricultural Rates Act of 1896 will make a total grant of over £4,000,000 per annum.

With regard to railway rates for agricultural produce he reminded farmers that the Railway Rates Tribunal was set up in November, 1921, and from that moment any agriculturist or body of agriculturists who had a grievance was entitled to bring it before the Tribunal. The attitude of the Government is that it is not prepared to adopt the suggestion made in the report of the economists that the Government should take the financial responsibility of a reduction, because it considers that the financial responsibility ought to fall on the railway companies and not on the Government.

The Minister then discussed the question of the Hop Control. He said that since 1917 hops have been controlled. At the present moment there is a large surplus of hops in hand, amounting to about half a million hundredweights. The reason for this excess is, shortly, that the Hop Control Committee expected the consumption of beer to be very much larger than it has been in the last two years. At the present rate of beer consumption the amount of hops required per year is 320,000 cwt. The full home crop on the present acreage is about 312,000 cwt. But the brewers insist on using foreign hops to the extent of one-sixth at least of their total consumption, so that, on this basis, the total annual supply of hops is 372,000 cwt. In other words there is a surplus of over 50,000 cwt. If the consumption of beer were increased by 50 per cent. the amount of hops required would be 480,000 cwt.

and the matter would become manageable. But if the consumption of beer does not increase it is obvious that the growers of hops in this country cannot go on producing the amount they produced last year.

The present control continues till 1925. A little time will be necessary to ascertain what is likely to be the future consumption of beer, but the Government recognises the claims of the hop-growers, and has announced that before the expiration of the control in 1925 it will deal with the question.

3.—In reply to a question in the House of Commons on 20th April, asking whether the Minister of Agriculture could make any further announcement as to the decision of the Government with regard to the Report of the Agricultural Tribunal, Sir Robert Sanders, Minister of Agriculture, made the following statement :—

In addition to the decisions already announced with regard to local rates, railway rates and hops, the Government have reached the following decisions with regard to other recommendations of the Report :—

Wheat Offals.—The Government do not accept the proposals of the Tribunal.

Malting Barley.—The Government accept the proposal that an Excise duty of 10s. a quarter be imposed on imported malting barley to be collected at the brewery, distillery or malthouse, with a preference of one-third on barley imported from the Dominions. It was part of the arrangement concluded with the brewing industry before the introduction of the Budget that this should not involve any rise in the price of beer. The Government propose to introduce a Bill dealing with the matter in the course of the present Session.

Potatoes.—The Government are not at present prepared to adopt the proposal of the Tribunal that imports of foreign potatoes be permitted only under general licence of the President of the Board of Trade.

Milk Production.—The Government are in favour of the proposals made in Paragraph 33 of the Report* and are considering how the proposed assistance can best be given.

Agricultural Wages.—The Government are not prepared to adopt the proposal for setting up six District Wages Boards. We intend, however, to introduce legislation to make compulsory the registration of agreements arrived at by Conciliation Committees.

* Para. 33 of the Report suggests State encouragement of the formation of depôts for collecting milk, and dealing with surplus milk.

The Budget and Agriculture.

THE Budget introduced by the Chancellor of the Exchequer on 16th April deals indirectly with agriculture. Farmers, in common with other classes, will welcome the proposed reduction of the Income Tax from 5s. to 4s. 6d., *i.e.*, on the smaller incomes from 2s. 6d. to 2s. 3d. The reduction in the beer tax will benefit agriculturists by the increased demand for malting barley and hops which should follow on account of the greater consumption of beer, while the repeal of the present duty of 4d. per gallon on some 6,000,000 gallons per annum of cider and perry should stimulate consumption in some degree and assist growers of cider apples and perry pears. Farmers who now carry on a trade by parcel post in dairy produce, eggs and other articles will be assisted by the reduction in parcel post rates of 3d. per parcel.

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Report on Milk and Milk Products.

THE Committee appointed "to inquire into the methods and costs of selling and distributing agricultural, horticultural and dairy produce in Great Britain, and to consider whether, and if so by what means, the disparity between the price received by the producer and that paid by the consumer can be diminished" has just issued its first Report, which deals with milk and milk products. The Report can be obtained through any bookseller or from H.M. Stationery Office, Imperial House, Kingsway, W.C.2.*

Starting from the point of production the Committee has conducted a complete investigation into the methods of distribution of milk and into the trading organisation which enables supplies to be collected from a wide area, conveyed to the centres of population and distributed in good condition from house to house. No previous examination has been made of the relation between the costs of distribution and the wholesale and retail prices, and this Report should prove of the greatest interest to all engaged either in the production or in the distribution of milk or milk products.

In addition, it has a direct interest to consumers as the Committee reaches the conclusion that the present costs of distribution are capable of reduction. The Report, in addition to reviewing and describing the whole organisation of the milk trade, deals with the possibilities of co-operation among pro-

* Cmd. 1854, price 3s. net.

ducers, the effect of the Agreement between the National Farmers' Union and the Dairymen's Federation, the trade in butter, cheese, cream, condensed milk and milk powder, and the packing and grading of dairy produce.

An idea of the general tendency of the Report may be obtained from its concluding sentences, which are as follows:—

"Finally, we desire to make it clear that where in the course of our Report we have found it possible to suggest reductions in the existing distributive margins we have done so solely in the interests of the progress and expansion of the industry itself. We are alive to the possibility of a considerable expansion of the dairying industry in this country, but we are also alive to the fact that any increase in the consumption of liquid milk or home-manufactured milk products can only be brought about by the willing co-operation of distributors in the direction of accepting a smaller percentage of profit on the resulting increased turnover.

"In the opinion of those most competent to judge, the food-value of milk cannot be over-estimated. As already stated, its consumption per head in the United States and other progressive countries is more than double its consumption in Great Britain. It is in the national interest that its consumption should be greatly increased here. A prerequisite is, however, a wide and implicit confidence on the part of the consuming public. To this end the public should be given the fullest information as to the essential facts of the industry and should have the assurance that both from the hygienic and economic standpoints, the industry is being conducted upon sound and progressive lines.

"We have already expressed our view that producers and distributors, with the co-operation of Government Departments and Local Authorities, should take every means of stimulating and encouraging the consumption not only of liquid milk but also of home-manufactured dairy produce. By efficient organisation this country can and should be made far more, if not entirely, self-supporting in its supplies of cheese, butter, condensed milk, cream and milk powder. In condensed milk, a profitable export trade is also possible. There are indeed many directions in which the industry can promote its own expansion and progress. The public demand for home produce of the first quality is undoubted, and as regards dairy produce, all concerned in the industry should feel it a reproach that, with our natural

advantages and accumulated experience, we are so dependent upon overseas supplies of these essential foods."

The Committee, of which the Marquis of Linlithgow is Chairman, consists of the following members:—

Sir Basil Mayhew, K.B.E., Mr. A. W. Ashby, Mr. Ernest R. Debenham, Dr. Charles M. Douglas, C.B., Mr. Percy A. Hurd, M.P., Mr. Rowland R. Robbins, C.B.E., Mr. R. J. Thompson, O.B.E., Mrs. Margaret Wintringham, M.P. The Secretary of the Committee is Mr. A. W. Street, and the Assistant Secretary, Mr. F. Grant, both of the Ministry of Agriculture and Fisheries.

It is continuing its investigations and will issue further Reports in due course relating to the sale and distribution of other agricultural produce, *e.g.*, fruit and vegetables, meat and cereals. The Report dealing with fruit and vegetables is expected to be ready in a month or six weeks.

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Reduction in Railway Rates.

AN official statement issued by the Railway Manager's Committee on 19th April shows that considerably reduced rates for the carriage of agricultural products by goods train come into effect on 1st May. In conjunction with a reduction in rates on certain other goods, the total cost to the railway companies is estimated at about £9,000,000 sterling per annum.

Goods Rates.—The new rates for agricultural products by goods train, as set out in the official statement, are :—

REDUCED FROM 75 TO 50 PER CENT. ABOVE PRE-WAR RATES.

Grain—flour, bran, sharps and other flour mill offal; barely, oats and wheat. Other than in two preceding groups.

Hay, clover, and straw.

Hops.

Vegetables—potatoes, carrots, turnips and mangel wurzels, E.O.H.P.

Machines and Implements.—The following articles as defined at page 226 of the General Railway Classification of Goods :—

Machines and implements, including agricultural carts and wagons.

Machines and implements in cases.

Chaff cutters, corn crushers, oil cake mills, root cutters and pulpers, and other machines for preparing food for agricultural purposes.

Harrows (iron), land rollers, clod crushers and horse gearing machinery.

Steam engines, portable, vertical, or horizontal, for agricultural purposes.

Also the following as named at page 227 of the General Railway Classification of Goods :—Hay-pressing machines, steam harrows, steam ploughs, steam plough vans, threshing machines, corn mills (portable), fitted with millstones, elevators, farm, staw sifters and cutters.

Agricultural seeds.

Brewers' grains, oil cake and cattle foods, provender.

Live stock at head rates, and/or at truck rates.

Butter, cheese, poultry (dead), eggs and fruit.

50 PER CENT. ABOVE PRE-WAR.—NO CHANGE.

Lime and limestone for agricultural purposes. Manure: town, stable and gas lime, E.O.H.P.

Passenger Train Traffic.—The new rates for passenger train traffic are :—

	Percentage over pre-war approx.	
	Present.	New.
General parcels scale } Owners' risk scale }	100	70
Horses, mules, &c.	118.75	50
Calves, rams, sheep, pigs, &c., in horse-boxes ...	118·75	50
Cows and oxen in horse-boxes	75	50
Live stock (except horses, &c.), in specially constructed cattle trucks	75	50

Companies' Statement.—An explanatory statement issued officially with the statement of the revised charges points out that since the railways were released from Government control on 15th August, 1921, they have made progressive reductions in railway rates and charges as their financial position from time to time warranted.

"In addition large reductions have been made in the dues and charges at railway-owned docks.

"The foregoing reductions were estimated to cost the companies not less than £35,000,000 per annum, and the general effect has been to reduce goods train rates from 112 per cent. to 75 per cent. above pre-war level and passenger fares from 75 per cent. to 50 per cent. above pre-war. The wages bills of the railway companies are to-day about 136 per cent. above the pre-war level. Wages form about two-thirds of the total railway costs. The railways are paying on the average about 70 per cent. more for all materials they have to purchase. To-day the railways are generally not earning the same amount of net revenue as they did in 1913.

"The reductions granted in goods rates in August, 1922, and in passenger fares in January, 1923, have not resulted in an increase of traffic sufficient to counteract the loss in gross revenue due to such reductions. The companies are therefore faced with a smaller revenue and the cost for working the increased traffic.

"The railway companies are fully alive to the necessity of bringing their charges down to the lowest possible limit, and

have shown their willingness to do so by the reductions that already been made. They have further so framed their programme as to give the greater reduction in the goods rates to those industries which appeared to need the greater consideration. With these objects in view the companies have given further consideration to the question, and especially to the views put before them by the members of the Agricultural Committee of the House of Commons, and have decided to make the further reductions now announced from 1st May, 1923. The concessions now announced are estimated to cost the railway companies upwards of £9,000,000.

"The companies have endeavoured to secure the co-operation of railway labour in order to make a larger reduction, but so far without success. Negotiations are proceeding, it being apparent that, failing some substantial reduction of expenditure due to high rates of wages and costly conditions of service, there is little prospect of further considerable changes in rates and charges. In the event of the negotiations with the railway trade unions being successful the companies will be prepared to make further reductions."

An official table of the new charges for goods train traffic other than agricultural products includes the following items of direct interest to farmers:—

—	Percentage of increase over pre-war.	
	Now.	New.
Agricultural manure, Classes "A," "B," and "C"	50	50
Returned empties	75	60
Small parcels	100	75
Cartage surcharge	9d. each end	*Nil*

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Agricultural Show in Sweden.

THE 22nd General Swedish Agricultural Show will be held at Gothenburg from 19th to 24th June next. It will be held in connection with the Jubilee Exhibition and Fair which will take place from May to September at Gothenburg to commemorate the 300th anniversary of the foundation of the city. The Swedish Government has expressed the hope that a party of British agriculturists will visit the show and exhibition, and at the same time take the opportunity of studying the agricultural conditions and institutions of the country. The Ministry will be officially represented and hopes to arrange for a party of

British agriculturists to accept the Swedish Government's invitation. The party will probably leave this country on 11th June.

The Swedish Government is arranging a tour including a visit to the famous Swedish seed-growing station at Svalöf and to other agricultural institutions and farms. A Swedish guide will be placed at the disposal of the party.

All breeds of livestock which in Sweden are qualified for entry will be exhibited at the agricultural show, but the most important will be Belgian horses; Friesian, Ayrshire and red-and-white Swedish cattle; Yorkshire pigs and Shropshire sheep. All of these are extensively bred in Sweden. Great interest will attach to collections of grain and seeds from the Swedish seed institutions, illustrating the latest achievements in plant breeding. There will also be demonstrations of experimental work, collections of dairy produce, agricultural machinery, etc.

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Worn-out Horse Traffic.

IN view of public interest in the traffic in horses between Great Britain and the Continent, it is felt to be desirable to publish in this issue of the *Journal* (see p. 175) a reply directed by the Minister of Agriculture, Sir Robert Sanders, M.P., to a letter from Miss A. M. F. Cole, of the Royal Society for the Prevention of Cruelty to Animals, and to a letter from the same lady of 5th March circulated to Members of Parliament and to the Press.

The traffic in worn-out horses has proved of some importance in the past, when it was felt to be essential on humanitarian grounds to take steps to ensure a cessation of anything amounting to cruelty in the treatment and shipment of horses. Owing to the action of the Department in the past few years the position is now quite different, the shipment of worn-out horses having entirely ceased, while the standard of fitness of other horses shipped is regarded by the Ministry as quite satisfactory. Horses unfit either to travel or to work without suffering would not be passed by the Ministry's Inspectors.

The question has been dealt with at some length in the letter under notice, in order that the present position should be made quite clear, and that any possible doubt entertained by the public as to cruelty to worn-out or other horses should be removed.

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THE Report of the Committee appointed to advise the Minister on testing and research in connection with agricultural machinery has now been presented. It is recommended that the Ministry should assume responsibility for the whole of the work relating to the development of agricultural machinery which has been divided into five categories, as follows:—

Report of Machinery Advisory Committee.

(1) *Series Investigations* (*i.e.*, investigations of short duration dealing with a number of machines for performing the same operation) should form a prominent part of the permanent work in connection with machinery during the next five years. Fees should not be charged to manufacturers or their agents, who should be willing to supply machines free of charge. The results should be published for general information. Series investigations should be arranged with groups of cultivating machinery, threshing machines, manure distributors, corn drills, potato planters, hedge cutting machinery and dairy appliances, etc.

(2) *Individual Tests.*—Facilities should be provided for a limited number of these tests. It is not necessary at this stage to draw up a scale of fees, but the applicant should be required to defray the whole cost except in special cases where it is considered desirable to remit all or part of the cost of testing. A Performance Certificate should be issued in every case and should show that under stated conditions (*a*) the implement had done certain specified work at a specified cost, (*b*) the condition of the implement at the end of the test, (*c*) the accessibility of working parts, replaceability and amount of wear, and (*d*) in the case of tractors or other prime movers, the horse power developed at the belt pulley and the drawbar. Performance Certificates should be published in full unless an entrant who has complied with the conditions of testing decides otherwise, in which case no use should be made of any part for advertising purposes.

(3) *Research.*—(*a*) *Investigations into the factors and principles underlying the use of various machines.*—The Ministry has determined the cost of mole draining, sub-soiling and deep tillage by various methods and has arranged to take records in order to ascertain the effects of these operations on the yield and quality of subsequent crops. Rothamsted is investigating the questions of soil tilth and the mechanical properties of the soil in relation to cultivating implements. All this work should

be continued and extended. In addition pipe draining should be investigated, and also rotary cultivation.

(b) *Problems arising out of series investigations.*—A commencement might be made with the more important residual problems which arose out of the Report on Potato Lifting Machinery.

(c) *New or improved Implements or methods for performing farming operations.*

(4) *Advisory Work including Assistance to Inventors.*—No change is recommended in the scheme of advisory work which is being carried out by the Ministry. So far as inventions are concerned, it is considered that the assistance already given by the Ministry's Technical Officers is all that the State can be reasonably expected to give and all that inventors can reasonably look for in the present financial condition of the country.

(5) *Exchange of Views between Farmers, Distributors, and Manufacturers.*—Hitherto farmers have had no organised means by which they could bring to the notice of manufacturers the kind of work on the farm which they would like carried out by machinery. The Committee consider that one of the functions of the new Advisory Committee, which it is proposed to set up to advise the Ministry generally on matters relating to agricultural machinery, should be to promote discussions between farmers, distributors, and manufacturers with regard to new or improved machines that may be needed and such important matters as the standardisation of plough fittings, etc.

(6) *Demonstrations.*—It is recommended that public demonstrations on a large scale should be regarded as business undertakings by which manufacturers can bring their goods to the notice of prospective customers and should be promoted by trade or agricultural organisations.

Two appendices accompany the Report: the first shows the work done by the Ministry since the issue of the Report of the Departmental Committee on Agricultural Machinery (Cmd. 506), and the other contains an exhaustive classification of existing machines and implements.

The Report is signed by all 29 members, but 4 append reservations to their signatures. The principal reservation is made by Mr. H. G. Richardson, who thinks that a separate Institute, attached to a University, should be set up to combine investigation and advanced teaching in agricultural engineering.

The Report has not been printed, but copies can be obtained on application to the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

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The Agricultural Index Number.

THE index numbers of prices of agricultural produce in England and Wales show that, on the whole, average prices during March were slightly lower than in February owing mainly to reductions in the price of fat cattle and pigs. The increase as compared with March, 1911 to 1913, was 59 per cent., against 63 per cent. in February, 1923, and 77 per cent. in March, 1922. Average prices were therefore 10 per cent. lower than a year ago.

The following table shows the percentage increase in each month since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911–13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	59
April	202	149	70	—
May	180	119	71	—
June	175	112	68	—
July	186	112	72	—
August	193	131	67	—
September	202	116	57	—
October	194	86	59	—
November	193	79	62	—
December	184	76	59	—

There was little change in wheat prices during March, but barley declined by 6d. per cwt. and oats by 2d. per cwt. as compared with February. Barley usually becomes cheaper in the spring, so that the index number only dropped by 4 points, but this cereal sold at only 8 per cent. above the pre-war price. Oats and wheat were 36 per cent. and 27 per cent., respectively, dearer than in March, 1911 to 1913. The very large supplies of potatoes caused a further decline in values, and prices in town markets were 12 per cent. below pre-war. Hay remained practically unchanged, town prices being again 42 per cent. dearer than in 1911 to 1913.

Fat cattle declined steadily in price during March, and on the average were 3d. per stone cheaper than in February, and 54 per cent. dearer than before the war. The decline in fat pigs was even more marked, averaging 8d. per stone, and prices were therefore only 77 per cent. above pre-war, against rather

more than double the pre-war price in January. Fat sheep, on the other hand, advanced by ¼d. per lb., but as this increase was relatively smaller than is usual in March, the index figure was slightly reduced. All classes of store stock became cheaper, though, except in the case of dairy cattle, the decline was not very appreciable. Dairy cows declined by nearly £3 per head, and were 58 per cent. above the pre-war price. Other store stock is usually dearer in March than in February, so that the small reductions in value this year caused appreciable drops in the index numbers. Store cattle and sheep were relatively cheaper than fat animals, but store pigs were still very dear as compared with fat pigs.

Cheese continued in short supply during March and rose to 95 per cent. above the pre-war price, but butter declined slightly. Both butter and cheese are very much dearer than in March, 1922. As a small proportion of the milk sold under the National Farmers' Union Scheme for yearly contracts was in excess of the quantities forwarded during November to February, and a few contracts in the Manchester district allowed for a reduction in price during March, the average price of milk was slightly lower than during February. The fall in egg prices, following the very sharp decline in February, was relatively less rapid than in the base years, so that the index number rose to 55 per cent. above March, 1911 to 1913. In March, 1922, eggs were 95 per cent. dearer than in pre-war years.

Norfolk Dispute.—A settlement was arrived at in the Norfolk labour dispute on 21st April, the terms being as follows:—

Agricultural Workers.

A wage of 25/- for a guaranteed 50-hour week. Any hours worked in excess of 50 to be paid for at 6d. per hour up to 4 hours per week and above 4 hours at overtime rates. The hours to be so arranged as to secure a weekly half-holiday. There is to be no victimisation.

Agricultural Wages.—It is estimated that the average weekly wage of agricultural labourers in England and Wales as a whole during March was about 27s. 10½d.

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THE INTERIM REPORT OF THE AGRICULTURAL TRIBUNAL OF INVESTIGATION.

AN interim report* has been issued by the Tribunal of Investigation, consisting of Sir William Ashley, Professor W. G. S. Adams and Professor D. H. MacGregor, with Mr. C. S. Orwin as Agricultural Assessor, who were appointed by the Prime Minister in December last "to inquire into the methods which have been adopted in other countries during the last fifty years to increase the prosperity of agriculture and to secure the fullest possible use of the land for the production of food and the employment of labour at a living wage, and to advise as to the methods by which those results can be achieved in this country."

After briefly summarising the serious conditions with which British agriculture is faced at the present time, the report refers to the importance of maintaining the arable area as the only means whereby the pre-war level of the home production of food and the employment of labour can be assured. The Tribunal have not yet completed their examination of agricultural conditions obtaining in foreign countries and reserve for a later report their final conclusions, but they have been impressed with the large place occupied, in some of the countries which have been under review, by methods of co-operation among farmers and by agricultural education.

The Tribunal are of opinion that apart from enabling the farmer to purchase his supplies more cheaply and to get better prices for his produce, co-operation when fully organised relieves the farmer of many problems of marketing, so that he is enabled to devote himself more exclusively to the real business of farming. They consider that foreign experience shows that co-operation is a natural basis of social and educational developments in agriculture, and are of opinion that the agricultural industry in Great Britain stands in need of developments along these lines, but they recognise that co-operation must come from the farmers themselves and they approve the established practice of Government grants being made to Agricultural Organisation Societies.

Three suggestions are made in the report in regard to education and research:—(i) That the system in vogue in Scotland

* Agricultural Tribunal of Investigation Interim Report. To be obtained through any bookseller or directly from H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2, price 6d.

of making appointments of County Agricultural Organisers through the Agricultural Colleges, would be preferable to the present English practice whereby the Organisers are appointed by the County Councils; and (ii) that the economic organisation of agriculture should have much greater attention both in the educational schemes of the Agricultural Colleges and in the programmes of work put in hand by the institutions where agricultural research is carried on; (iii) that it is a matter of first importance to extend research work in the direction of testing new systems of farm management, particularly as regards the maintenance of live stock on arable land.

The report contains a large number of recommendations, summarised below, on agricultural questions.

1. *Agricultural Credit.*—The Tribunal agree with the proposals in regard to long-term credit of the Committee on Credit Facilities in Agriculture, though they consider that farmers, organising for the joint handling of their products, should be able to obtain credit for the erection of buildings and purchase of plant against the security of their uncalled capital. With regard to short-term and intermediate credit, the Tribunal take the view that a more elastic system is called for than that proposed by the Committee, and to this end suggest that approved associations of farmers for purchase and sale should not be excluded from the scheme to be placed before Parliament.

2. *Railway Rates.*—An immediate and material reduction of railway rates on farm produce and farm supplies is urgently required. If the Railway Rates Tribunal are unable to make a substantial reduction in the rates charged on agricultural produce, the Government should intervene and become financially responsible for a reduction of not less than twenty-five per cent. on the existing rates.

3. *Local Rates.*—The contribution from the Exchequer should be a sum equal to half of the expenditure falling upon rural rates in the preceding twelve months instead of the sum fixed in 1896 as being at that time half the rate, and agricultural hereditaments, other than the farm houses and cottages, should pay on half rates as is the case with land.

4. *Wheat Offals.*—Importers of wheat flour should be required to import a corresponding quantity of offals and an export duty should be imposed on wheat offals of ten per cent. *ad valorem.*

5. *Malting Barley and Hops.*—A duty of 10s. per quarter on imported malting barley and a duty of 20s. per cwt. on imported hops should be imposed, and the hop control should be abolished.

In each case it is proposed that a preference of one-third should be allowed to the Dominions.

6. *Potatoes.*—The import of foreign potatoes should only be permitted by licence for specified periods after consideration of the extent of home supplies and the freedom from disease of proposed foreign imports.

7. *Sugar Beet.*—The exemption of home-produced sugar from excise duty should be continued sufficiently long to allow the experiment of producing sugar in this country to be thoroughly tested.

8. *Milk and Cream.*—The import of milk and cream should only be allowed when there is satisfactory evidence that their production and transport are subject to a standard of hygienic regulation equal to that required in this country. Imports of dried milk should be certified as free from adulteration, and as regards imports of preserved liquid milk an analysis of the contents should be plainly set out on the tins. It is also suggested that active assistance should be given to the formation of farmers' associations to deal with the collection of milk and the conversion of surplus milk into dried or preserved milk, butter and cheese.

9. *Marking of Agricultural Produce.*—Imports of agricultural produce should be clearly marked, as far as is practicable, to indicate the country of origin, and steps should be taken by the Departments of Agriculture to require misleading descriptions to be discontinued.

10. *Agricultural Wages.*—There should be established about six District Wages Boards to cover the whole of England and Wales, each with executive powers in its own area and uncontrolled by a Central Board. The Boards should confine themselves to the enactment of minimum wages and the granting of permits of exemption, and should not be regarded as fixing in effect the actual rates of pay.

11. *Relief of Rural Unemployment.*—Various suggestions are made with regard to the relief of rural unemployment, such as the development of lime burning and limestone crushing.

12. *Local Administrative Machinery.*—The desirability of improving the local administrative machinery for the purpose of advancing the organisation of the agricultural industry is urged.

Professor MacGregor makes a reservation in regard to the proposals numbered 2, 3, 4 and 5 above.

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LAND RECLAMATION:

SOME ASPECTS OF LAND RECLAMATION, WITH PARTICULAR REFERENCE TO THE ALLEVIATION OF UNEMPLOYMENT.

A. T. A. DOBSON,
Assistant Secretary, Ministry of Agriculture and Fisheries.

FOR the purpose of the remarks that follow, Land Reclamation may be divided under three headings:—

(*a*) Reclamation of water-logged land by means of drainage operations.

(*b*) Reclamation of derelict heath and moorland, by means of acts of cultivation.

(*c*) Reclamation or recovery from the sea of areas of foreshore, by means of the construction of embankments.

It is not intended within the compass of this article to deal in more than a superficial manner with the types of reclamation mentioned under (*a*) and (*b*). Moreover, it is not proposed to deal in any way with reclamation of small areas of land by such operations as "warping," as they obviously cannot be regarded as affording any relief to unemployment.

(*a*) **Reclamation of Water-logged Land by Means of Drainage Operations.**—Although there are here and there specific areas, like the Borth Bog in Wales, where the carrying out of extensive drainage operations constitutes the sole means of rendering a hitherto derelict area suitable for cultivation, there is so much land already actually under cultivation that could be rendered more productive by maintaining existing drains in a serviceable condition that it is hardly necessary to consider such special areas as that referred to. This has been amply demonstrated by the reception which has been accorded by Drainage Authorities, as well as by landowners and occupiers, to the Ministry's Drainage programme for the alleviation of unemployment, during the autumn and winter of 1921-22, of which an account was given in this *Journal* for September, 1922. An even more favourable reception has been accorded to a similar programme repeated during the autumn and winter of 1922-23, of which an account will be given in due course. It seems superfluous, therefore, to attempt to draw any radical distinction between derelict land that requires drainage to bring it back into cultivation, and good land that is being increasingly

damaged year after year by neglect of the simple drainage operations that constitute some of the elementary rules of ordinary estate management. Suffice it to say that there is probably no more profitable method of keeping land in good heart and of increasing its productiveness than by paying meticulous attention to the maintenance of its drains, arterial and otherwise.

(*b*) **Reclamation of Derelict Heath and Moorland by Acts of Cultivation.**—The Ministry has records of many areas of more or less derelict heath land, which provide, at the best, the roughest pasture. In isolated cases there is even evidence of the land having at some time or other been under the plough. In a few instances during the War, when Agricultural Executive Committees tackled such areas, the results, as, for example, in the case of Wadfast Moor, in Cornwall, were markedly successful. To embark upon these undertakings, however, as a means of alleviating unemployment is quite another matter. As a rule the areas lie at a great distance from the larger towns where unemployment is usually most acute. Moreover, they are sufficiently inaccessible to the neighbouring villages, where unemployment is less acute, to render it necessary either to lorry the unemployed from their homes to the scene of operations, or to construct especially hutted camps, in which case, apart from the additional expense, there are all the difficulties as regards recreation, etc. In many cases, however, there are preliminary difficulties as regards the acquisition of the necessary land, and, even if those are surmounted, there is no guarantee that, once the land has been ploughed, it will not be allowed to revert again to its original state, especially if, as is the case in many of the heath lands, the results of such cultivation prove indifferent on account of an insufficient depth of soil. Moreover, there is the all-important question of equipment. In isolated cases no doubt small patches of heath land can be reclaimed and added to neighbouring farms, but the attempted reclamation of large and remote areas at once opens up the whole question of the equipment, in other words, the provision of buildings both for man and beast, and even the construction of roads or tracks. The capital costs in this respect are prohibitive and, with the other considerations above referred to, combine to render an undertaking of this nature hopelessly uneconomic. Where an area of this kind has been surveyed and presents possibilities as regards cultivation, the only effective way of bringing it back into cultivation is to

attack it boldly with steam tackle of some kind. Thus it ceases at once to offer any prospects to those in search of a means of relieving unemployment.

(c) **Reclamation or Recovery from the Sea of Areas of Foreshore.**—Reclamation of foreshore presents an interesting problem, and affords the real reason for this article.

The mere prospect of robbing the sea of areas over which for centuries it has flowed at regular intervals, appeals tremendously both to the man in the street and to the professional engineer. The latter's appetite is whetted by a fascinating problem where there is unlimited scope for sharpening his wits, and in which he realises by instinct that there is the adventure of what must always be a doubtful contest between man and nature. The very prospect of such a contest makes the problem all the more enticing to the expert.

To the man in the street, however, the undertaking merely presents itself as an obvious and simple expedient for getting something for nothing. He sees miles of out-marsh on which samphire—the presence of which is a sure sign that the sea is receding—may or may not be abundant, apparently only covered at intervals by spring tides; and he immediately visualises a long embankment within which thousands of acres of new land are brought under the plough. Practically never does the man in the street realise any of the difficulties, and it is the object of this paper to divulge some of them. This is all the more necessary in view of the prominence that is given from time to time to possible reclamation schemes as a means of alleviating unemployment.

Let us deal with a few of the inherent difficulties straight away without wasting unnecessary words on them. (1) In the first place most areas, where the foreshore is what is termed "ripe" for reclamation, are as remote from the centre of acute unemployment as the heath and moorlands already referred to above. There are consequently all the difficulties attendant on the construction of hutted camps.

(2) The areas are usually in rural districts, and if large numbers of town unemployed are transported into such districts, the immediate result is that the regular farm labourers of the neighbourhood are drawn towards the works in the hope of the higher wages approaching those of the navvy. If, as in the case of the Ministry's drainage schemes, the rate of wage is fixed to accord with the agricultural earnings of the district, it is soon found that difficulties and dissatisfaction arise by virtue

of the fact that many of the unemployed on the work are urban unemployed, who resent being paid a wage lower than that to which they are accustomed when engaged on other classes of relief work, such as roads.

(3) If no preliminary difficulty has arisen as regards the acquisition of the necessary land, there is invariably the problem of equipment of the reclaimed area with roads and buildings, as well as the burning question of maintenance when the work has been completed. This difficulty is probably the least appreciated by the well meaning, but misguided enthusiasts, who spend their time urging the Ministry, not infrequently through their local Member of Parliament, to embark upon the wildest schemes of reclamation, and in areas where difficulties, obscure to the layman, readily present themselves to the engineer, whose business it is to advise. And yet the task of maintenance is in many cases the greatest objection to work of this kind ever being begun. It is the cost of maintenance that is absolutely crippling the agricultural land in certain parts of the country, and is creating the intolerable position revealed by the instances hereafter described.

Around Rye and Winchelsea, in Sussex, there is a valuable area of marsh land where, sooner or later, the position as regards sea encroachment, or flooding from inland waters will become critical. Rye and Winchelsea lie about two miles apart on two hills which rise out of a flat area of marsh which has at some time or other been gradually recovered from the sea by natural processes assisted by the hand of man. They were originally, as is well known, two of the Cinque ports, and were practically on the sea about 250 years ago. They are now separated from the sea by a frontage of marsh extending anything up to two miles deep. The sea front is some 5 or 6 miles wide, and is bounded on the western extremity by the cliffs in the vicinity of Hastings, and on the eastern extremity by Dungeness. Across this front there is a perpetual littoral drift of shingle from west to east, except near the easterly extremity at Cliff End, where the flood tide, after being checked by the Hastings cliffs, surges on to the low beach, and perpetually threatens to burst through over the marsh land immediately inside the shingle beach. A serious break through at this point would involve the flooding of some 14,000 acres of valuable marsh, which is now used for fattening off sheep. The only method of guarding against such an eventuality and of preserving the foreshore is by the construction of groynes, which

cost anything up to £800 apiece, and their constant maintenance. It will be readily realised that extensive works of this kind involve the levying of a rate per acre which is absolutely crippling to the owners of the marsh. Although the Ministry has, by means of grants from its Unemployment Fund, enabled a great deal of useful work to be done at a comparatively small cost to the owners, as only one-fourth has to be refunded, nevertheless this comparatively small contribution will involve a special levy of £2 an acre on certain of the marsh land which the works are designed to protect.

Further east, other areas of marsh land are threatened in another manner. The River Rother, after skirting the hill, upon which the town of Rye stands, proceeds in a straight south-easterly direction towards the sea, passing on its way the little hamlet of Rye Harbour. For many years the outfall channel of the River Rother into the sea has presented very serious difficulties, owing to the littoral drift of shingle above referred to, which has tended to block the river mouth. An elaborate scheme for the construction of training works to maintain the outfall channel was drawn up by the late Sir John Coode. His scheme involved a short training wall on the eastern side, and a longer one on the western side, one effect of the latter of which would have been either to arrest or divert into deep water the shingle drifting from the west. The authorities proceeded to construct the shorter or eastern wall first, and then, finding their funds exhausted, left the western wall, or in other words the more important one, unconstructed. The result has been that the drift of shingle into the channel has continued uninterrupted, and in the last two years, has piled up across the mouth of the river an effective barrier, which has completely changed the course of the outfall, and made the harbour almost completely impracticable for ships of any kind.

From a recent inspection, it would appear probable that the accumulated shingle will continue to accrete towards Dungeness, and make it increasingly difficult for the river to find any outlet at all. In that event a vast freshwater lake would be formed all over the marsh lands on which stands the small hamlet of Rye Harbour, lying between Rye itself and the sea.

The particulars of this case are given in detail, because they offer a striking example of land which has been recovered from the sea with valuable results extending over many years, but which is now likely to return to something worse than

its former state, because the cost of stabilising the sea defences has proved out of all proportion to the value of the agricultural lands which can be assessed for the purpose.

To take another example. Shortly after the termination of hostilities, the Ministry itself embarked upon a scheme of reclamation in the Wash, where there are undoubtedly large tracts of foreshore "ripe" for reclamation. The area originally intended to be reclaimed was some 1,500 acres, but owing to the need for national economy, the original programme was finally curtailed, so that only about 300 acres were ultimately enclosed and these were the less valuable portion of the original area. Taking everything into account the cost worked out at something like £160 per acre. The area enclosed, although offering valuable pasture, can only be turned into arable land in its entirety, when the channels of the old sea creeks, which still remain in the enclosed area, have either been filled in or have flattened out as the result of many years of ploughing. The bank has stood well, but will require careful attention for some years to come, especially at one particular point where the North Sea, under certain conditions of wind and tide, strikes it with its full force. Until, therefore, the out-marsh in front of this particular section of bank has been able to collect a sufficient "apron" of silt outside the toe of the bank to break up wave action, this particular section of bank will always require a certain amount of money to be spent on it, to guard against the possibility of it being breached by an occasional heavy sea.

The heavy burden involved by maintenance, does not, however, only arise in connection with land which has been recovered from the sea naturally or reclaimed by specially constructed embankments. On many parts of the coast the sea is actively encroaching, and although the Royal Commission on Coast Erosion, which reported in 1911, found that on the balance there was more land being automatically reclaimed from the sea than was being encroached upon by the sea, the menace of sea encroachment remains a serious one, because of the heavy burden involved on the agricultural land affected by virtue of the rates levied on it to provide moneys for its protection.

The Lincolnshire coast from a little north of Skegness, right up as far as Mablethorpe, represents an area where there is a perpetual contest going on between man and Nature. If once the sea were allowed to effect a serious break through on a

wide front, thousands of acres would be permanently submerged. Rail communication would probably be interrupted, and untold suffering caused in hundreds of homesteads. Already the sea has made severe inroads. Far outside the existing sand dunes on the sea-shore, will be found tile drains, of a kind for which exhibition prizes were awarded nearly 100 years ago, and which are still *in situ* in the original lines along which they were laid when the land was corn-growing land, even within the memory of some of the oldest inhabitants of these parts. The sea has now, however, reached the final line of sand dunes which are of varying thickness. In several places they are so inadequate, that spring tides occasionally breach or overtop them into the rough pasture land beyond. Throughout only a short length of this coast there is in the rear a bank constructed by the Romans as part of that which extends all round the Wash.

During the past two years the Ministry of Agriculture by means of its Unemployment Relief Grant has been able to save the situation by advancing sums of money which could never have been found by the Commission of Sewers responsible for maintenance; but, sooner or later, the works which have recently been constructed will require renewal, and the position will again become critical. Since it is a fact that some of the areas on this coast are rated at £1 per acre to pay for a bank which has been subsequently breached, and that complete protection, say, for 30 years might involve an expenditure in the neighbourhood of a quarter of a million sterling, it will be realised why so much weight is attached to the item *maintenance*.

During the last three or four months, pressure has been brought to bear upon the Ministry to reclaim a large area of foreshore lying in the estuary of the Humber. The scheme was typical of those submitted by enthusiasts who have no appreciation of the difficulties. In the first instance a soil survey was carried out by two experts who reported that, of the 10,000 acres claimed to be reclaimable, only about 250 acres were of sufficient value for the purpose. A subsequent survey by the Ministry's engineers showed that even if it were possible to enclose a larger area by means of an embankment, such an embankment would have to be constructed by means of hopper or other barges operating from the sea-ward side, as it is entirely impossible to carry out operations on the mud area proposed to be reclaimed. This consideration alone at once

ruled out the scheme as one likely to offer relief to the unemployed. There were also legal difficulties which need not be enlarged upon here.

Only recently a speech was delivered in the House of Commons, urging the Government to undertake land reclamation. Reference was made to modern machinery, which was stated to have done valuable work in Canada. If modern machinery could be used for this purpose, it would be of no use to advance land reclamation as an unemployment scheme; but those who advance the cause of modern machinery appear to overlook the fact that no modern machinery has yet been devised which would work effectively on an out-marsh, which is, at varying intervals, liable to inundation by the tide. Possibly some form of machine with caterpillar appliances and all working parts enclosed might be devised to meet the situation, but the matter has not been attacked from that point of view, seeing that hitherto the advocates of land reclamation have only advanced it in the interests of unemployment relief.

As already intimated the above instances have been given somewhat in detail in order to bring into prominence the heavy cost of maintenance, as the importance of this item with each new reclamation scheme tends to recede further and further into the background.

The cost of maintaining sea defence works on a stretch of coast where the conflict between man and Nature is constant may be taken to work out at something like £300 to £500 per annum per mile. Assuming the average depth of the agricultural land requiring protection to be a quarter of a mile—in many places it is of course considerably more—the cost of maintenance would be nearly £3 per acre in perpetuity. As the average rental value of this land could hardly exceed 50s. an acre, it will be seen that the position is utterly uneconomic.

Again, in the case of an area of land which has been artificially reclaimed by means of an embankment, quite apart from the initial cost of the work of actual reclamation, the reclaimed land is immediately saddled with a maintenance cost of something like £300-£400 per mile for at all events a period of, say, 10 years. As the reclaimed land must usually be allowed to settle down for some years before its full value is attained, it is obvious that here again the cost of maintenance is out of all proportion to the rental value of the land at any rate for a considerable number of years.

That this factor is beginning to be appreciated in various parts of the country is evident from the appeal that is being made to the Government from all quarters to make the cost of sea defence works a national charge. This was carefully considered by the Royal Commission on Coast Erosion in 1911, who, appreciating the difficulty of reconciling the value of agricultural land on the coast with the enormous cost of maintaining sea defence works for its protection, saw no good reason for transferring to the State the cost of those maintenance works. It does not appear that any such radical changes have taken place during the last 12 years as would justify a modification of the views held by the Royal Commission.

In conclusion, I cannot close the above remarks without a word of thanks, for his advice and assistance, to Mr. C. H. J. Clayton, M.Inst.C.E., the Ministry's Chief Drainage Engineer. It is his enthusiasm for everything connected with land drainage that affords the inspiration for my remarks. His recent retirement from the Ministry after 41 years of loyal and distinguished service will create a gap which it will be difficult to fill, but it is satisfactory to know that, in spite of his retirement from the service of the Crown, his services will not be lost to the cause of land drainage generally.

* * * * * *

A TRIAL OF HARVESTING MACHINERY:

BINDERS, AND A BINDING AND STOOKING MACHINE.

THE self binder seems a natural development of the reaping machine, but it was only in the latter part of the 19th century that it was produced in approximately its present form. The advantages of mechincal methods of harvesting were appreciated in classical times, and Pliny makes reference to machines in use on large estates in Gaul during the first century. These consisted of big shallow baskets with forward projecting teeth, pushed through the crop by horses harnessed at the rear. The fall of classical civilisation, however, meant for many centuries the neglect of mechanical contrivances, particularly in agriculture, and it was not until about 1870 that the invention of the Appleby Knotter resulted in the construction of a complete binder that in its general principles did not differ greatly from the machines in use to-day. By the invention of a machine for

stooking the sheaves delivered by the binder, a further stage has been reached, and it is now possible to cut and stook cereal crops by means of machinery.

In order to obtain information for the guidance of farmers as to the comparative cost and utility of cutting and stooking corn by various methods the Ministry arranged for a test to be carried out with the following machines:—

a. Massey Harris Binder drawn by 3 horses.
b. McCormick Binder „ „ tractor.
c. Two McCormick Binders „ „ tractor.
d. McCormick Binder and Stooker drawn by tractor.

The tests took place in the vicinity of St. Albans, namely, at "Oaklands," the Hertfordshire County Farm Institute, through the courtesy of the Hertfordshire Agricultural Education Committee, and at Cunningham Hall Farm, through the courtesy of the occupier, Mr. R. Baum.

Good crops of both oats and wheat were obtained at "Oaklands," but at Cunningham Hall Farm the crops were not so good, and in parts had been badly laid by the previous bad weather. On both farms the soil was medium loam containing a large number of stones, while in parts rain had caused the ground to be soft. At the Institute Farm, a steep gradient at one end of the field added to the severity of the tests, but all the other fields were level.

Before records were taken, each machine was permitted a preliminary cut on its particular plot. Records were taken of:—

1. Number of men employed in cutting.
2. Number of men employed in stooking.
3. Consumption of fuel and lubricants.
4. Acreage cut in the total working time.
5. Stoppages—time lost and cause.
6. Weight of crop cut.

Observations were made of the quality of work done, and any other factor affecting the economic or mechanical efficiency of the machine.

Agriculturists are, as a rule, familiar with the design of binders, and detailed descriptions of the machines have been omitted. The differences in the construction of the various types of binders on the market are not very pronounced. Such differences as do occur relate principally to minor details, such as the construction of the knotter.

(*a*) **The Massey Harris No. 5 Horse Binder** Manufactured by Messrs. Massey Harris, Ltd., 53/5, Bunhill Row, London, E.C. Price £58.

	Oats.	*Wheat.*
Acreage cut per hour	1·33 ...	·85
Cost of cutting per acre	4s. 8d. ...	6s. 0d.
„ „ stooking „	1s. 8d. ...	1s. 11d.

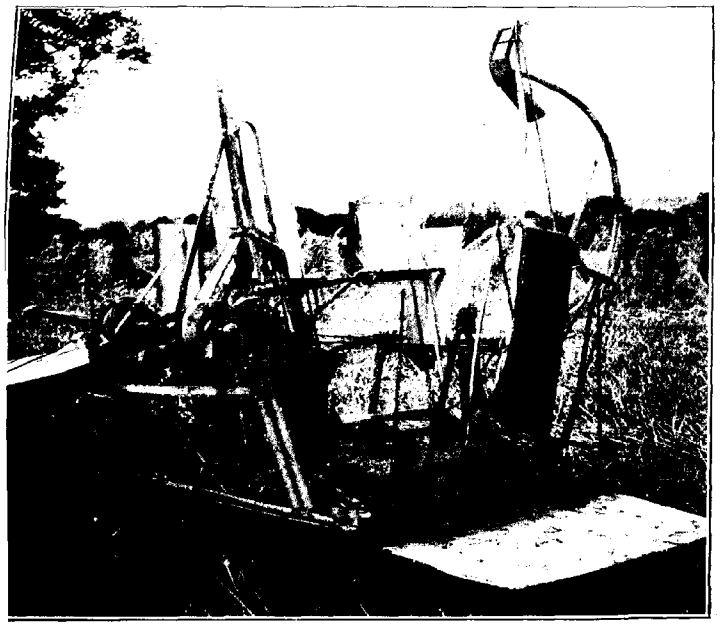


FIG. 1.—International Stooking Machine.

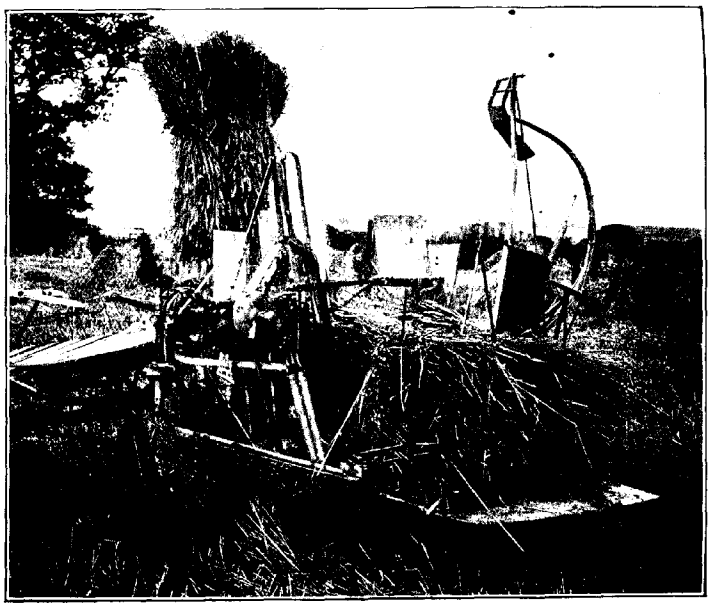


FIG. 2.—Stooking Machine, showing Stook being formed.



FIG. 3.—Binder with Stooking Machine, from which a Stook has just been dropped.



FIG. 4.—Two Tractor-drawn Binders with Steering Apparatus.

The Massey Harris Binder used in these trials had been in use for 12 years, but was in excellent condition. The machine was drawn by three horses and operated by one man. Four men were employed for stooking. The horses were replaced at midday by a fresh team.

The crops of oats and wheat were generally thin, but a considerable amount of undergrowth caused frequent choking of the canvases. The oats were cut at an average speed of 1·95 m.p.h. and the wheat at 1·41 m.p.h.

The work done by this binder was satisfactory in every way, and in spite of the soft surface in parts, the horses easily hauled the machine.

(*b*) **One McCormick Binder**—Supplied by the International Harvester Co. (Great Britain), Ltd., 80, Finsbury Pavement, London. Price £58. Fordson tractor, £120. Nelson Simplicity Binder Hitch, £5 10s. Agents, Messrs. A. Dugdale, Ltd., 65, Conduit Street, London, W.1.

	Oats.	*Wheat.*
Acreage cut per hour	1·51 ...	1·25
Cost of cutting per acre	5s. 1d. ...	5s. 11d.
„ „ stooking „	1s. 4d. ...	2s. 0d.

The only difference between horse drawn and tractor drawn binders lies in the form of hitch used.

The Nelson Simplicity Binder hitch (see Fig. 5) consists of two parts, the first of which is attached rigidly to the tractor drawbar, and the second to the binder stub pole. The second part is swivelled to the first and when working on the straight, occupies a position inclining at roughly 45° to it. The hitch therefore brings the binder more to the left and so permits a full cut to be made, and in addition greatly facilitates cutting at corners.

The field of oats upon which the machine was first employed had a steep gradient at one end. Owing to the great number of stones on the ground, close cutting was not attempted. The canvases were choked on three occasions owing to the quantity of undergrowth.

A part of the field of wheat was not standing well, and it was necessary to miss cutting one end on each round. Time lost for this cause has been deducted from the total working time. The Fordson tractor was not able to work so fast on wheat as on oats, the speed being 1·98 m.p.h. as against 2·66 m.p.h.

(*c*) **Two McCormick Binders** supplied by the International Harvester Co. (Great Britain), Ltd. Coupled by "International" hitch and drawn by International Junior and Saunderson Tractor. Price of Binders £58 each. Hitch £8 15s., International Tractor £250.

	Oats.	*Wheat.*
Acreage cut per hour	2·72 ...	2·37
Cost of cutting per acre	4s. 4d. ...	4s. 9d.
„ „ stooking „	1s. 3d. ...	1s. 10d.

Two McCormick binders were coupled together by means of a special steering hitch manufactured by the International Harvester Co., and were drawn by an International Junior tractor on wheat, and by a Saunderson on oats.

The hitch is so constructed that the relative position of the second machine to the first may be accurately adjusted by means of a conveniently-placed steering wheel on the rear machine. By this means the second binder is enabled to cut a full swath on the straight and to negotiate corners. There-

was a certain amount of difficulty however in steering both machines round corners.

The oat crop was fair, but occasional patches of undergrowth choked the canvases. The time lost through stoppages, however, was not large.

The wheat was only a moderate crop and was so badly laid in places that good cutting was impossible. On this plot the two binders were drawn by an International Junior tractor.

On both fields, the great capacity of the machines was a very noticeable feature. The sheaves discharged from the binders usually dropped in pairs, one from each machine, and this greatly facilitated the labour of stooking.

(d) **The McCormick Binder and Stooker.**—Supplied by the International Harvester Co. (Great Britain), Ltd. Price of Binder, £58. Price of Stooker, £50. International Junior Tractor, £250.

	Oats.		*Wheat.*
Acreage cut per hour	1·52	...	1·14
Cost of cutting and stooking per acre ...	6s. 1d.	...	7s. 6d.

The stooking machine is a device of special interest and calls for a detailed description. It is attached to the rear of the binder and stooks the sheaves while the binder is travelling. The power for performing the various operations, is obtained by means of a shaft, driven from the crank shaft of the binder. The sheaves are delivered on to the fork in pairs. The first sheaf is held on the binder platform until the arrival of the second, when a "kicker device" delivers them simultaneously. In so doing, a trip lever is actuated which causes the fork carrying the sheaves to describe a semi-circular movement, thus delivering the sheaves into the stook setter with their butts to the rear. During these trials the experiment was made of inserting a V-shaped dividing tine into the stook setter for the purpose of opening and spreading the base of the stook. The number of sheaves contained in the stook may be determined by previous regulations, but the stook may also be tripped at will by the operator irrespective of the number of sheaves it contains. Upon the requisite number being placed in the stook setter, a compressor arm, which also forms the needle, is set in motion, causing it to compress the stook and tie it. The knotter is similar to that in use on the McCormick binder. The stook setter is wider at the rear than at the front, to assist in making stooks that will stand well when discharged. It is provided with an inclined bottom which is pivoted, permitting it to tilt to the rear and discharge the stook after being tied. The stooks are discharged with a quick movement, and as they leave the stook setter, tines spread the butts in order to give the stooks a substantial base. Facilities are provided for raising or lowering the stook setter, as necessitated by the height of the crop.

An International Junior tractor was used throughout to draw the machines. The weight of the stooker is considerable and the draught is increased disproportionately owing to its method of attachment, but the tractor at no time showed signs of being overworked.

One man only is required to operate the binder and stooker. The stooker was readily attached to the binder and worked with very little attention, while the proportion of time lost was comparatively low.

The oat crop was not a very good one, and the stooks made by the machine generally had the tops too large and insufficient air space were made.

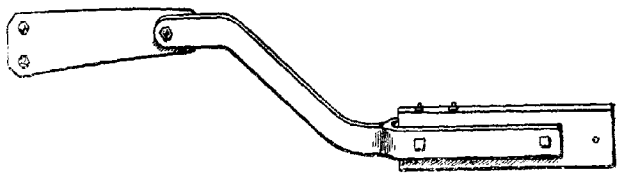


Fig. 5.—The Nelson Simplicity Binder Hitch.

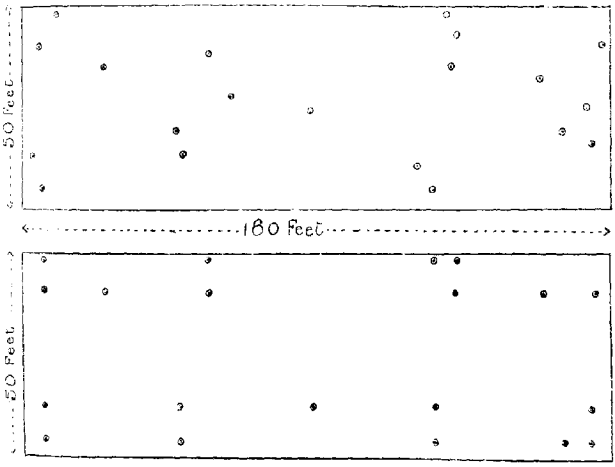


Fig. 6.—Showing Positions of Stooks.
Top, as left by Stooking Machine;
Bottom, as left by Hand Labour.

The stooker was first used on wheat at Oaklands, but owing to there being an insufficient acreage, it was afterwards transferred to Cunningham Hall Farm. At Oaklands there was an excellent crop with long straw, and upon this the stooking machine did very good work, leaving the stooks with small conical tops and adequate air spaces. After being transferred to the other farm the machine was not able to do such good work, chiefly owing to the poorer crop. The air spaces left were considerably increased later by the introduction of a V-shaped tine inserted in the cradle, which divided the sheaves as they were delivered by the fork.

The number of sheaves in each stook is determined by previous regulation by the operator. It was observed that one or two of the stooks in each field were not tied properly, and in addition about one in twenty did not stand properly after being tripped. These are minor faults which may readily be overcome. In the latter case the wider spreading of the butts would increase stability and provide for greater aeration.

The irregular disposition of the stooks as illustrated in the accompanying diagrams (Fig. 6), is a disadvantage as it materially increases the labour of carting.

Attention is given later in the Report to general economic factors governing the use of a stooking machine.

(To be concluded.)

* * * * * *

DEVON LONGWOOL SHEEP.

EDWIN LAWRENCE,
President of the Devon Longwool Society.

ANCIENT writers state that the foundation of the Devon Longwool Breed is of great antiquity, and from time immemorial it has been extensively kept in the vales and on the hills of the most Western Counties of England. It is indigenous to the West, and has proved its adaptability therein, but no one has yet been able to trace its origin. In Youatt's "Complete Grazier," these sheep are described as the Devonshire polled sheep, or Devonshire Nott, crossed with the Leicester, producing a sheep with a white face and legs, known as the Bampton Breed, giving a heavy carcass with a long fine wool. Another writer claims a parish in Somerset to be the place of development of this cross of Leicester with the old Devon Nott; he adds that it is the best breed living.

That this breed of sheep in the past attained great weight is confirmed by a record of a Mr. George Turner, of Thorverton, Devon, who had forty two-year-old wethers whose carcasses were estimated at 40 lb. per quarter. In 1858 a Mr. John Bird, of Volis, near Taunton, sold four-fifths of his shearing

wethers at fifteen months old at 28 lb. per quarter dead weight. Both these lots had been fed without any cake or corn. Spooner's history of sheep stated that a wether of this breed slaughtered in 1835 weighed 70 lb. per quarter. Mr. J. J. Walker wrote to the *Meat Trades Journal* in 1846, giving particulars of two sheep, bred and fed by Mr. T. Kingdon, of Thorverton, Devon, which when slaughtered weighed, the wether 78 lb. per quarter, and the ewe 57 lb. per quarter, being the heaviest sheep ever killed in Her Majesty's Dominions.

The *Farmer and Stockbreeder* in 1899 published the report of an independent writer who said "this breed should claim a fair share in the export trade. Amongst its many qualities are size, strength of constitution, heavy fleece of excellent wool, width and depth of carcase, of superior flesh, great hardiness, and aptitude to lay on flesh and not fat."

This breed of sheep for many years before the War well proved its suitability for export. For the purpose of founding flocks abroad ewes and rams have been exported, also rams for crossing with merino and other breeds, resulting in heavy fleeces of silky wool, and early maturity mutton, showing rapid growth and production of a fine class of meat. The writer amply proved this by Smithfield results, when Devon Longwools competing against all Longwools (Lincolns excepted), four years in succession (1911-14, the only years competing) gained first prize and the breed cup. Some of these sheep attained the dead weight of 40 lb. per quarter, at nine and a half months of age. The progeny of Devon Longwool ewes crossed with a Hampshire Down ram, won first prize three years in succession (1911-13) at the Smithfield Club Show, in competition with entries numbering fifteen to twenty representing various Longwool and Shortwool crosses; these crossed lambs reached a carcass weight of 120 lb. per sheep at nine and a half months old.

Export trade before the War was successfully carried on by various breeders, members of the Society. One noted breeder exported several consignments of rams and ewes to South America, the Government of Uruguay, New South Wales, Australia, Buenos Ayres, and Montevideo. Other breeders have exported sheep to South America and Australia.

Devon Longwool flocks are principally kept in North and East Devon, West Somerset and Cornwall, while flocks are established in other counties. The popularity of the breed is accounted for by the qualities already mentioned, viz.:—great

depth of flesh; for early forcing a suitable weight carcass is easily obtained; and the long silky fleece is of great weight, before the War commanding a remunerative price often equal to cross-bred wool.

Owing to the collapse of Russia, formerly a prominent buyer of English long wools and heavy woollen goods, and the fact that the Government held heavy stocks of wool, longwool has for some time met a low dull trade, but recently the prices have advanced considerably. There is every reason to look for further rises, and no doubt this class of wool will soon reach a more profitable price. When everything is considered, this breed doubtless shows equal profit to any other breed from wool value, as the weight clipped on an average would be double or more the weight of any Shortwool breed, ordinary flocks yielding 12 lb. per sheep and 4 lb. per lamb. Some breeders have recorded heavier weights than those quoted. The writer once clipped three rams, two fleeces weighing 29½ lb. each, and the other 30 lb.

The breed has been greatly popularised and rendered additionally useful by the efforts of the Devon Longwool Sheep Society, which was formed many years ago. While not being a large organisation, it is very successfully conducted on practical lines, the members being farmers and successful breeders largely of the tenant-farmer type. As most of the breeders reside in the West of England, the distance from the large shows and the consequent heavy expenses incurred by showing, account very largely for the fact that the breed has not been so largely represented as it ought to have been at the Royal and other prominent shows.

Flock reports show that the ewes are excellent mothers and heavy milkers, very hardy at lambing time, and eagerly sought after by those who do not keep standing flocks, for running on grass or feeding partly on turnips as is the custom in the south-west. They answer admirably when crossed with a Shortwool ram, for fattening lambs, which come forward very rapidly. For early maturity they will easily attain a marketable size and weight—60-70 lb. at six to eight months old.

These sheep at all ages will do equally well on grass or with a portion of soiling crops, and for constant winter feeding off roots on arable land cannot be beaten.

The Ram for Crossing Purposes.—Rams of this breed coming from the hills of Devon and the Western Counties are hardy and unusually active, and will cover from sixty to eighty ewes. They have been successfully crossed with the Merino abroad,

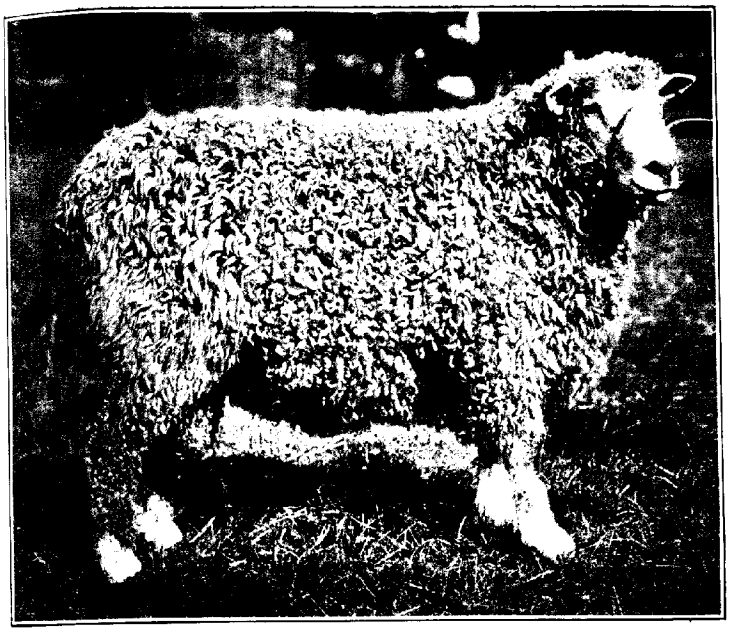


FIG. 1.—Typical specimen of a Devon Longwool Ram.



FIG. 2.—Group of Devon Longwool Rams, sold for an average of 47 guineas each in 1918.

and with Shortwooled ewes at home, where they increase the size of carcass and the weight of wool.

Owing to their early maturity they are excellent for the production of early fat lambs, and are also equally satisfactory for summer grazing or finishing off on arable land during the winter. The principal ram sales are held at Taunton, Tiverton, Exeter, and Barnstaple, during the months of July and August.

Points to notice in selection may be summed up as follows:—

Rams.—Activity, with a bright eye, denotes promise and suitability for service.

Head should be of fair length with a broad face and nose, points of nostrils black in colour, the face of a clear colour, free from black or blueness; with a broad poll well covered with good wool, free from hair and coarseness.

Ears, of fair length, not thick or heavy, clear in colour, showing a few prominent black spots of pea-size (the saying of old breeders being that every spot is worth a guinea). There should be an absence of wool on the ears.

Neck should be massive, rising from the body, not long but well set up, giving a bold appearance.

Fleece, an important feature, should have a strong curl all over the body, of a long free silky wool with no mixture of hair, extending at the hindquarters down to the feet, thereby producing quality and quantity of high-grade wool.

Skin should be white and clear, free from black spots or blueness.

Back, level and straight, with a firm back and loin of flesh and minimum of fat, having a thick tail and plump legs of mutton. The animals should stand on short legs with fair-sized bone and feet, these features denoting thick flesh and strong constitution. If these points are secured the results will be all that can be desired for quality, early maturity and profit.

Females.—Similar remarks will apply with some exceptions, viz., if the farmer's aim is to fatten lambs only, he should select ewes and rams showing most readiness to put on fat quickly, producing a back with a fat touch (as is looked for by the buyer of fat lambs) thereby sacrificing somewhat growth and weight of carcass, also wool weight which is not valued in a killing lamb.

The Secretary of the Devon Longwool Society is Mr. A. Gerrard, Wivelscombe, Somerset, who is always pleased to give information concerning the breed, and to enrol new members.

SEED MIXTURES FOR GRASSLAND.

PROFESSOR R. G. STAPLEDON, M.A.,
Welsh Plant Breeding Station, Aberystwyth.

IT is never easy to decide on a seed mixture to suit particular soils and circumstances. To-day, when every penny must be saved, money must only be spent on those species and varieties which (if, of course, the "take" be satisfactory) may be depended upon to succeed.

Need of Experiments.—It is a difficult matter, even after close inspection of a field, to prescribe the *right* mixture for it. It is at best only possible to prescribe a "sensible" mixture which may be hoped to give good results; the farmer himself, after making a few simple trials, could probably do better.

In the first place the farmer should always draw up his own mixture or at all events know precisely what and how much of each kind of seed he has sown. In the second place, on some small corner of every field seeded out he should sow some entirely different mixture to the one he has relied upon. Perhaps he has not included wild white clover in the general mixture—it should be sown on the special corner. Perhaps he has included 20 lb. of perennial rye grass and only, say, 2 lb. of cocksfoot—he might sow at the rate of 8 lb. of each in his corner. He may have used 10 lb. of red clover in his mixture—let him try 4 lb. in his corner. This would involve very little trouble, but in a very few years would put the farmer in the position of being his own expert on seeds mixtures for his farm.

Importance of Strain.—It is not enough merely to choose the species to be sown; often, as for instance with white clover, red clover and cocksfoot, the proper strain or nationality must also be selected.

With *White Clover* this is especially important. Wild white clover is at present much more expensive than commercial white Dutch, but commercial Dutch should only be used in leys sown down for at the most two years for sheep grazing. In this case it would be sown in large amount probably with rye grasses only. Yet even for short duration leys wild white is valuable, because in conjunction with perennial rye grass and rough-stalked meadow grass it tends rapidly to form a dense sward and to suppress weeds and bent grasses. For longer

leys and for permanent grass it is of course invaluable; it is probably the one seed of commerce capable of producing really perennial and persistent plants.

With *Red Clover* too nationality and strain are very important. There are only two main types of red clover—early and late. The early are commercially known as broad red clovers—sometimes also called cowgrass or giant hybrid cowgrass. The late are late-flowering reds or single-cut cowgrass, sometimes also supplied under the names of cowgrass or giant hybrid cowgrass. Unfortunately the seed of the two types cannot be distinguished. The early reds flower earlier in the spring and tend to produce rather more in the autumn of the seeding year than the general run of the lates. They aftermath abundantly, but are not usually long persisting. The lates flower 10-14 days later than the earlies, have not time to produce a heavy aftermath, persist longer, and some of them, even in the first year, produce heavier hay crops than the earlies. Some, too, are extra late flowering and extra persisting, as for instance the strains grown in Montgomery and in the Wadebridge district of Cornwall. For leys of two years and upwards the lates should be mainly relied on. Unfortunately few of the foreign nationalities of red clover consist wholly or even mainly of late-flowering types. Home-grown seed, so far as the north and west of England are concerned, does, on the whole, better on long duration leys than foreign seed.

Of *Cocksfoot*, New Zealand seed,* in trials both at Cockle Park and at Aberystwyth, has proved decidedly superior to Danish and American, particularly for long duration leys. French seed, as was shown some time ago in Denmark and more recently in Wales, is inferior for the longer leys.

Complex *versus* **Simple Mixtures.**—Complex mixtures (mixtures of a large number of species) are still popular for the longer leys and permanent grass, and until comparatively recently were almost wholly relied upon for these purposes. Recent work in Sweden has shown—and in this country it is coming to be realised—that the complex mixture is likely at best to be wasteful of seed and will frequently not give as good results as a relatively simple mixture. In America, too, the mixtures now generally employed for establishing long duration swards seldom contain more than about six species. The

* There is not much New Zealand Cocksfoot on the market, but if its merit were more fully recognised by farmers, larger supplies would no doubt be forthcoming.

observations of Osvald* on this subject, although based on researches conducted in Sweden, are of particular interest and are undoubtedly equally applicable both to the conditions and to the practices prevailing in this country. He points out that for a considerable time pasture trials were conducted on the principle that the artificially produced swards should be made to approximate as nearly as possible to the natural grasslands. A consequence of the application of this principle has been the inclusion of a large number of species in the seeds mixture—an erroneous idea which in his view has been based on an imperfect knowledge of the composition and ecology of grasslands. More recently, the object aimed at has been to combine, in the species included, high yield, winter hardiness and permanency, and to adopt treatments calculated to create the best conditions for the development of a good sward.

In the opinion of the writer there are three distinct and final objections to the complex mixture:—

(1) There is too much competition between the different species.

(2) Some of the included species are almost certain to be unsuitable to the particular conditions.

(3) The seeds of different species require very different conditions, if they are to germinate and thrive.

Competition.—Some species make very rapid growth during the seeding year; others start slowly and, during the first autumn after sowing, produce practically no keep. The quick-growers naturally tend to crowd out the slow, especially when the slow are "top" species, requiring light to grow properly. Italian rye grass, unless sown in very small amount, crowds out other plants badly, and so also to some extent do the early red clovers. The former is sometimes included in long duration mixtures to keep down weeds (work which should be done by wild white clover) but it will quite effectively suppress meadow fescue, meadow foxtail and some other grasses, and considerably interfere with cocksfoot and Timothy. Perennial rye grass if sown too thickly (20 lb. or in some cases less) will interfere with cocksfoot and Timothy (especially when these are sown thinly), while if sown in less amount (14-16 lb.) it will hamper meadow fescue and meadow foxtail.†

* Osvald, H., Några nyare synpunkter vid uppgörande af gräsfröblandningar för slåtter-och betesvallar på torfjord. *Svenska Mosskulturföreningens Tidskrift*, 1920.

† Generally speaking both the rye grasses germinate considerably better than all other grasses, except perhaps Timothy. This better germination must be taken into account, as well as the rate of seeding, when considering their tendency to hamper other plants.

Thus we should include in a mixture only such species as agree well together. For hay, species and strains must be chosen which will flower about the same time; this is impossible if numerous species are included. With late-flowering red clover we should choose a late strain of cocksfoot (this is a point in favour of New Zealand cocksfoot). With Timothy predominating, one of the latest late-flowering red clovers, such as an approved Montgomery Red, is to be preferred.

Unsuitability to particular Conditions.—If plants unsuitable to their surroundings are sown in competition with many better adapted species their chances are naturally poor, and the smaller their share in the seeding the less their chance will be. Thus, to sow ½ lb. or even 1 lb. of Chewings fescue, of rough-stalked meadow grass (on some soils), of smooth-stalked meadow grass (on other soils), of golden oat grass and meadow foxtail, is often sheer waste.

Many species are so unsuited to particular conditions that even when sown on almost even terms with better adapted competitors, they will not succeed. Chewings fescue, for instance, may compete on some types of soil, on most it cannot. Again meadow fescue will only succeed in competition on very fertile soils, and much seed of this grass is probably sown in vain.

Different Conditions for Germination of Different Species.—The question of depth of sowing and method of covering seeds is important.* The question of temperature is perhaps equally important.

Seeds mixtures are generally sown in late March or in April according to district. At that time the temperature is generally ideal for the rye grasses and the clovers, species which usually make a better early growth than most of the others in a mixture. The temperature even in April, however, is often not so favourable for cocksfoot nor well suited to grasses like Chewings fescue and the meadow grasses, while for meadow foxtail it is often fatal.

Thus for April sowing, cocksfoot, if sown in competition with rye grass, must be sown in large amount; the meadow grasses and Chewings fescue if included at all, should not be stinted.

It will thus be gathered that a "sensible" mixture is one which contains only those species which, at the date of sowing,

* See Williams, R. D., "Depth of Sowing Grass and Clover Seed," this *Journal*, April, 1922; May, 1922; and March, 1923.

and in the competition which they are likely to encounter, have the best chance. There will scarcely be a large number of such species. Consequently a "sensible" mixture is generally one consisting of a very few species each sown in either considerable or moderate amount.

How to decide upon a Grass Mixture.—It might be thought that an examination of the species composing any good permanent grass on the farm would be enough to show the farmer what he should include in a new seeds mixture. This is only very partially true. He finds, let us say, rye grasses or meadow fescue and fine leaved fescues, or meadow foxtail thriving exceedingly—but can he now purchase *the self-same strains* of these? And if he can, will they, in the face of the difficulties described above, be sure to succeed? Fields or plots, sown down with a *known mixture*, examined three or four years after sowing, are a much better guide.

Permanent fields, however, will give some guidance, especially for long duration leys or permanent pasture. If the examination showed the presence of meadow fescue, it would probably be wise to sow this bountifully and to reduce the rye grass considerably, so as to give the fescue a good start. Suppose wild red clover is abundant. It would then probably pay to take pains to secure a reliable strain of the long-persisting Montgomery type. If wild white clover is not much in evidence on the older fields, then it should be included in the new mixtures. If perennial rye grass is practically absent, it would be sound to include about 2 lb. of crested dog's tail* in the new mixture, especially if sheep grazing is desired. Nevertheless, for most conditions, a good mixture will be drawn up chiefly by choosing from a *limited* number of "*bed-rock*" species and only including others when either they are supported by strong local evidence or when the mixture and the time and conditions of sowing are all planned chiefly in the interests of one particular species which it is desired to include.† The "bed-rock" species for leys of two years and upwards and for permanent sowing are:—perennial rye grass, cocksfoot, Timothy, rough-stalked meadow grass and crested dog's tail, with the various strains of red, Alsike and wild white clovers.

* On certain types of soil (especially those on which perennial rye grass does not establish itself permanently) there is no doubt of the value of crested dog's tail. The appearance of the dry flowering stalks is no indication that stock do not graze, or have not grazed, the leafage.

† For instance, the enormous sowings of the grasses such as Chewings fescue and the like on specially prepared tilths for lawns and putting greens.

Manuring.—This question, which cannot be dealt with here, is as important as, if not more important than, the choosing of the mixture. A young ley, however, must have phosphates, of which a sufficient amount, either in the form of basic slag or one of the approved mineral phosphates, should be applied before sowing. On certain soils the addition of potash is almost equally important.

Purchase of Seed.—In the purchase of seed the farmer is protected by the Seeds Act, 1920, and by the Seeds Regulations, 1922. In the case of cocksfoot and of red and white clover (as well as of certain other specified seeds), the seller must state (what is very important for the farmer to know) the country of origin. The farmer can also obtain, for a small fee, a report on seed which he proposes to sow, from the Official Seed Testing Station, Huntingdon Road, Cambridge.*

The farmer should not expect or desire so good a germination from English and particularly from Welsh clovers as from foreign, nor from wild white as from white Dutch clover. Nor should he object to New Zealand cocksfoot, if it be found to contain a considerable quantity of perennial rye grass. Correct strain is of more importance than superlative germination, or, provided injurious weed seeds be not present, than absolute purity. Of course where the germination is low, the seed rate must be adjusted accordingly.

Price of Seed.—In deciding upon a mixture the question of cost is generally uppermost, but obviously there should be no hesitation in paying more for a long than for a short duration mixture. The farmer's rule should be to buy the best (as judged by strain, absence of injurious weed seeds and reasonable germination) of comparatively few species, rather than to spend the same money on inferior seed of many species. For leys of two years and upwards, he must first ask himself how much wild white clover seed is required. On some fields, particularly if plenty of phosphates have been used and liming regularly practised, wild white clover spreads rapidly without sowing. In such cases the farmer may be tempted to leave wild white out of his mixture; but it is generally worth while including even so small a quantity as ¼ lb. to assist in suppressing weeds. Having decided the quantity, he must ascertain the cost of reliable seed and then arrange the rest of his

* For fuller particulars as to the Act and the Regulations, and also as to the Official Seed Testing Station, see Form No. 728/C.S., obtainable on application to the Ministry.

mixture according to what he was prepared to spend, less what the wild white clover is going to cost.

Examples of Mixtures.—Seeds mixtures fall into the following classes:—

(*a*) Stubble or autumn bite; (*b*) One-year ley; (*c*) Two-year ley; and (*d*) Three-year or upwards including permanent.

Stubble or Autumn Bite.—More use might be made of stubbles. When stubbles are left idle in order to start cleaning the land at once, well and good, but too frequently they are left untouched until ploughing is begun in late autumn or winter, by which time weeds have got a good hold. If the stubble is clean to start with, then, unless something is grown on it, the winter's rains simply wash out the nitrates. In the south and east of England stubbles are often sown with catch crops such as crimson clover as soon as the corn is harvested. In the north and much of the west, including Wales, owing to the late harvest, the stubbles are almost always left idle until well into early winter. In Wales a plan has been adopted of sowing seeds with the corn, solely for the purpose of providing autumn and winter keep until ploughing. Quick growing red clover and Italian rye grass—the latter especially—have given the best results. Clover is expensive, it does not hold out so well into the winter and it makes harvesting more difficult. And there is the danger of clover sickness. Italian rye grass is free from these disadvantages. A seeding of 15 lb. per acre is recommended, but even 7 or 8 lb. will be useful. It may be sown directly after the corn and harrowed in at the same time.*

One-Year Ley.—There are two main questions:—(*i*) whether stubble and winter grazing are wanted as well as a hay crop, and (*ii*) whether (*a*) one or two hay crops, or (*b*) a hay crop and abundant aftermath grazing, or (*c*) one heavy hay crop, without much stubble grazing or aftermath, be required. Whether Italian rye grass or perennial rye grass should be sown or both, and if both, in what proportions, the farmer himself must decide.

Italian rye grass sown with clover alone does not as a rule give so heavy a hay crop as perennial rye grass with clover, but Italian gives a more leafy hay and does not lodge nearly so readily as perennial. Where stubble grazing is also wanted Italian should be either solely or mainly sown. If Italian

* The writer is indebted to Professor R. G. White, M.Sc., for information as to trials conducted by him at Bangor on the question of stubble grazing.

and perennial are mixed, the Italian will predominate over the perennial unless only a small amount of the former is sown. Mixing certainly helps to prevent lodging, to afford winter keep and to increase the aftermath, but there is the disadvantage that perennial flowers earlier than Italian.

Late-flowering red will generally give a heavier single hay crop than the early reds, but does not contribute so freely to a second hay crop, and is not likely to give so much stubble grazing.

Alsike frequently succeeds better than the red clovers in cold and wet situations, and at high elevations. It is not often necessary to employ other grasses than the rye grasses for one-year leys, but Timothy is useful, and not too expensive, on wet situations and drained peats. Timothy flowers much later than the rye grasses and so is better sown alone than in mixture with them. Tall oat grass may give a very heavy first hay crop, but is expensive, and where the mixture is chiefly rye grass there is no particular advantage in adding it.

The following standard mixtures are only intended to give an idea of the seeding rates which are generally adopted:—

1.—Catering chiefly for a very heavy single Hay crop.

Perennial rye grass	14 lb.
Late-flowering red clover	4–6 „
Alsike clover...	1–2 „

2.—Catering as much or more for Stubble Grazing and Aftermath as for Hay.

Italian rye grass	14 lb.
Broad red clover	4–6 „
Alsike Clover	1–2 „

3.—Compromising between all needs, and being content to have the various species coming into flower over too long a range of time.

Italian rye grass	6 lb.
Perennial rye grass	10 „
Late-flowering red clover	2–3 „
Broad red clover	2–3 „
Alsike clover	1 „

4.—For conditions unfavourable to the Rye Grasses but particularly favourable to Timothy.

(*a*) Timothy	10 lb.
Alsike clover	6 „
(*b*) Timothy	10 lb.
Late-flowering red clover	4 „
Alsike clover	2 „

Two-Year Ley.—What has been said about the one-year ley applies in the main to a two-year ley, with the following exceptions:—(i) what counts in a two-year ley is the gross yield over

the whole period; it should not therefore be expected to provide continual stubble grazing; (ii) Italian rye grass will not contribute much in the second year, and should therefore be greatly reduced or entirely excluded; (iii) unless aftermath is particularly wanted in the first year broad red clover should be excluded, or only sparingly sown. For a two-years' ley late-flowering red and Alsike are distinctly the proper clovers. A small amount of wild white might be included; it will add to the fertility of the soil and help to suppress weeds.

More money may naturally be spent on a two-year than on a one-year ley, and grasses should be used which will give as high (or higher) yields in the second as in the first harvest year. Thus perennial rye grass may be either wholly or partly displaced by cocksfoot, Timothy or tall oat grass. Whether it should be wholly displaced by whichever of the other three is most suited to the conditions, is difficult to decide. In the interests of gross yield and of getting the included species to flower together, there is much to be said for excluding it, especially on other than the most fertile soils. The question of extra cost (except in the case of Timothy) often decides against leaving out perennial rye grass altogether.

The following is an attempt to indicate "sensible" mixtures for a two-year ley having regard to the considerations discussed. In cases where stubble grazing is urgently needed, 2 lb. of Italian rye grass might be added to each:—

1.—For soils where Perennial Rye Grass is known to hold well into the Second year.

Perennial rye grass	14 lb.
Late-flowering red clover	4–6 ,,
Alsike clover	1–2 ,,
Wild white clover	¼–½ ,,

2.—For soils where Cocksfoot bulks very much more heavily in the Second year than does Perennial Rye Grass.

(*a*)	Cocksfoot	10 lb.
	Timothy	4 ,,
	Late-flowering red clover	4–6 ,,
	* Alsike clover	1–2 ,,
	* Wild white clover...	¼–½ ,,
(*b*)	Perennial rye grass	8 ,,
	Cocksfoot	8 ,,
	Timothy	3 ,,
	Late-flowering red clover...	4–6 ,,
	* Alsike clover	1–2 ,,
	* Wild white clover	¼–½ ,,

* If a reliable strain of late-flowering red (of the Montgomery type) is employed, then to save expense Alsike clover and wild white clover can be omitted; the Montgomery should ensure a sufficiently good clover root to plough down at the end of the second year.

3.—For soils particularly adapted to Timothy.

Timothy	10–12 lb.
Alsike clover	4–5 „
Wild white clover	¼–½ „

Note.—Since Timothy flowers so much later than other grasses a combination with rye grass is not here recommended. Alsike clover and Timothy agree well together, and the inclusion of Alsike to the total exclusion of late-flowering red clover renders the mixture an exceptionally cheap one.

4.—Where from local evidence it is desired to rely wholly or largely upon Tall Oat Grass.

(*a*)	Tall oat grass	16 lb.
	Late-flowering red clover	4–6 „
	Alsike clover	1–2 „
	Wild white clover	¼–½ „
(*b*)	Perennial rye grass	8 „
	Tall oat grass	8 „
	Late-flowering red clover	4–6 „
	Alsike clover	1–2 „
	Wild white clover	¼–½ „

Note.—Tall oat grass has the advantage of providing very early keep in the spring, but if heavily grazed at that period the grass is quickly killed out. The above mixtures are probably prohibitive in price unless the circumstances are exceptional—evidence, however, suggests that small sowings of tall oat grass are seldom satisfactory or profitable.

Long Duration Leys and Permanent Grass.—The mixtures required to produce a good ley for three years and upwards differ little from those required for a permanent sward. The reason of this is that, for the sake of fertility, there should always be a good sward full of clover to plough down when a ley of three years or upwards is broken. Again, in a field that has been down for about six or more years, the herbage will fall into two classes. Much of it will consist of wild plants which have established themselves naturally, and only a part of it of plants which were sown in the original mixture and have become permanent. These latter plants are, moreover, just those which should usually be sown for a ley of three years and upwards.

In all long duration mixtures the object should be to get a good "sole" as soon as possible and to crowd out weeds and bent grass. To this end wild white clover, perennial rye and rough-stalked meadow grass work admirably together.* For providing a good "adult" sward, wild white clover is essential.

* See, for instance, "Formation of Perennial Pastures" in Reports on Experiments for 1920–21, Department of Agriculture, University College of North Wales, Bangor.

How much should be sown is not so easy to say. As little as ¼ lb. has proved sufficient to get a quickly formed sole, and as much as 4 lb. has justified its cost. Opinions differ whether the "sole" will suffer by taking a heavy first hay crop from a field sown for a long duration sward. With a good "take" and good harvest weather the formation of "sole" is not likely to suffer. On the other hand, plot trials in Wales have clearly shown that if the hay crop is exceptionally heavy and the harvest weather bad, wild white clover may be to a large extent killed out, even when the original take has been excellent.

There are two classes of long duration mixtures:—(1) Those from which a first hay crop, and also, if required, later hay crops may be taken; these will usually be sown under corn. (2) Those sown for grazing only; such mixtures are frequently sown on poor, outlying fields, from which corn will not be taken, and are sown without a covering crop or under rape.

(1) *Mixtures designed to give Hay and Pasture.*—The following mixture, advocated by Professor Gilchrist, has been found, over a wide range of country, equally suitable for a three-year ley or for permanent grass. It may be taken as an example of the simple mixture, although the seedings are rather heavy, and may be altered to suit various districts and conditions:—

Perennial rye grass	16 lb.	True late-flowering red clover	4 lb.
Cocksfoot (New Zealand) ...	10 „	Trefoil	1 „
Timothy (Scotch)	4 „	*Wild white clover	1½ „

In many districts trefoil cannot be relied upon; thus, under the conditions of high rainfall and non-calcareous soils which prevail over large areas in Wales and the west of England, this species but seldom succeeds and should not be included in the mixture.

The following are suggested as "sensible mixtures" for such districts; to either of them not more than 2 lb. of Italian rye grass may be added where sheep are kept during the winter and the fields are likely to be heavily grazed during the first autumn and winter after sowing:—

(a) Simplified as much as possible.

Perennial rye grass ...	12 lb.	Late-flowering red clover (Welsh)	4 lb.
Cocksfoot (New Zealand)	8 „	†Alsike clover	1–1½ „
Timothy	4 „	Wild white clover... ...	½–1½ „

* In many cases the wild white clover might be reduced to ½ lb.

† Where red clover invariably takes well, Alsike can often safely be left out. At high elevations (above 600–700 ft.) Alsike often does very well and may sometimes altogether replace late-flowering red.

(b) Rather more complex.

Perennial rye grass	8 lb.	Alsike clover	1–1½ lb.
Cocksfoot	6 „	Late-flowering red clover	4 „
Timothy	4 „	Wild white clover ...	¼–1½ „
*Rough-stalked meadow grass ...	1½ „	†Chicory	1–2 „
*Crested dog's tail ...	...1½–2 „		

Where cocksfoot predominates in mixtures for leys two rules should be observed. First, the hay should be cut comparatively early, before the seed has begun to develop and ripen. Secondly, the swards should be grazed hard at least once a year. If hay has been taken, this can be done on the aftermath.

Some will object to the amount of cocksfoot in the mixtures above, but until further trials have been made it is hard to suggest anything else but cocksfoot if hay is required on soils where perennial rye grass is not productive after the second year. Golden oat grass, sown thickly, would probably meet the case, but it is expensive and usually of low germinating capacity. Timothy might completely take the place of cocksfoot in some cases, but those who object to cocksfoot, generally object to Timothy in quantity. The same may be said of tall fescue which, furthermore, is expensive. This last is, however, capable of thriving on many classes of poor soil and of providing relatively abundant late winter and early spring keep.

On more fertile soils where perennial rye grass holds longer, the best substitute for cocksfoot is undoubtedly meadow fescue. Farmers might try a small area with mixture (*a*) reducing the rye grass to 8-10 lb. and sowing meadow fescue (about 8-10 lb.) instead of cocksfoot. On excessively thin and dry soils in regions of low rainfall it is probable that smooth-stalked meadow-grass (*Poa pratensis*) and Chewings fescue may sometimes be helpful. The latter grass is, however, frequently of very poor germinating capacity and thus, from the point of view of establishing a take and of resisting subsequent competition, needs, if included, to be sown in considerable amount. In such situations there is little doubt that ribgrass (*Plantago lanceolata*) is a really valuable plant and may be included in the mixture.

In the case of all the above mixtures, short and long alike, the quantities given are for broadcasting—not drilling—under a corn crop, on an average tilth as regards weeds and suitability for the seeds. Under these conditions there is bound to

* These two grasses have both done well, especially on soils too poor to carry a permanent rye grass herbage. If both are sown, 1½ lb. of each would be the outside sowing. If only one, then 2 lb. would not be too much.

† Chicory is sometimes objected to in the hay, but on many soils persists well and gives excellent spring grazing.

be a waste of seed.* A farmer who has carefully studied the date and methods of sowing and covering seeds might often quite safely reduce the quantities.

(2) *Mixtures designed to give Grazing only.*—In a mixture designed for grazing only, there is no absolute need to sow the "coarser" hay grasses and no risk of the hay crop hampering the wild white clover. There is also an advantage in sowing otherwise than under a corn crop. There is no danger to the grass from lodged corn; there is time to clean and prepare the land thoroughly; and the sowing can be done at the most favourable moment. Consequently seedings may be reduced.

The following mixtures are perhaps still in the experimental stage and are offered for trial as suggested on page 130. It is suggested that the mixtures should be sown under about 2 lb. of rape per acre or without any covering crop:—

1.—Perennial rye grass ... 10–12 lb.	3.—Perennial rye grass ... 8 lb.
Wild white clover ... 2–4 „	Rough-stalked meadow grass 4 „
2.—Perennial rye grass ... 10–12 „	Wild white clover... ... 2–4 „
Late-flowering red clover (Welsh) ... 4 „	4.—Perennial rye grass ... 8 „
Wild white clover ... 2 „	Rough-stalked meadow grass 4 „
	Late-flowering red clover (Welsh) 4 „
	Wild white clover 2 „

The above mixtures would almost certainly be more applicable to regions of high than of low rainfall, and in the case of each, if it is intended to use the fields for heavy winter and early spring grazing with sheep, the addition of a few pounds of the coarser grasses, such as cocksfoot and Timothy, would perhaps be an advantage.

* * * * * *

CRIMSON CLOVER.

T. WIBBERLEY, M.I.A., F.L.S.

THE growing of Crimson Clover or Trifolium (*Trifolium incarnatum*) is at present more or less confined to the southern counties of England. In this area the crop is usually grown on stubble land after winter cereals. Many unsuccessful attempts have been made to grow it in the west and north, but the failures have probably been due to the fact that the spring cereals after which the trifolium has been sown, are harvested too late for the successful sowing of this crop. It has now been proved over wide areas that winter oats, and on light soil winter barley, can be just as successfully raised in Northumberland as in Hampshire, provided the corn is sown early, preferably in late August or early September, and if

* See this *Journal*, April, 1922; May, 1922; and March, 1923.

necessary grazed back before winter. These cereals, when sown early, will ripen two or three weeks earlier than spring sown corn, and often the stubbles can be cleared in sufficient time to sow trifolium. Generally, however, it is not wise to sow it in the north of England later than, say, 10th September, and in the south of England later than 20th September.

Varieties.—There are three varieties of trifolium, viz., early, medium, and late, and in addition also a white flowering variety. If the three varieties are all sown at the same time, they come in for use at different times in the following summer, but the same result may be achieved by sowing any one of the varieties at intervals of from seven to ten days.

Preparation of the Land.—The main essential for the successful growth of crimson clover is a firm seed bed. For this reason when sown on stubble land, anything in the nature of elaborate cultivation is a disadvantage. If the land is ploughed and worked to a fine seed bed the crop usually fails. All that is needed is to give the stubble one or two runs with the drag harrow, or for preference a spring tooth harrow, then broadcast the seed and roll. A similar method can be followed when the crop is sown in summer, say, on a vetch and cereal stubble when the latter crop has been cut for hay or silage or fed off with sheep. Again, the crop can be successfully grown with spring sown lea oats, the seed being sown when the corn is brairded, and chain harrowed and rolled.

Sowing on corn or vetch stubble as described above necessitates fairly clean land. Where the land is foul and it is desired to sow the crop in summer or early autumn, it is wise to sow a little white mustard along with the crimson clover to keep the land covered-in until the crimson clover is established.

Rate of Seeding.—The common method is to sow from 20 to 24 lb. per acre, but this method has many drawbacks. If the crop for any reason fails, there is nothing to fill up the land, whereas if it succeeds and the area sown is considerable, long before the crop can be consumed it is so thick that it rots at the bottom, making it difficult to convert into hay. It is also very necessary to emphasise the fact that there is the greatest danger in feeding crimson clover (especially to young lambs) when the flowering period has reached an advanced stage. The florets of crimson clover are very hairy in the advanced stage, and if fed to sheep cause the formation of hairballs, which result in obstruction in the digestive tract. "Hairballing" is also common amongst horses which have been fed on

crimson clover hay made from over-ripe trifolium. A more useful crop for folding off with sheep or pigs, or for conversion into hay or silage, and also a surer crop, can be obtained by sowing on a corn or vetch stubble about 14 lb. of Italian rye grass, and 10 to 12 lb. of crimson clover per acre. On foul land 6 to 10 lb. white mustard can also be included in this mixture.

When sown with lea corn or autumn or spring sown tares on firm land, the rate of seeding should be about 14 lb. of Italian rye grass and 7 lb. of crimson clover. Another very marked advantage of sowing smaller quantities than is usual of crimson clover along with Italian rye grass is that often two crops can be obtained from the one cultivation and seeding. For instance, sown in autumn on stubble land the crop can be folded off in May or early in June and then refolded in September. Where this system of double feeding is practised, it is necessary to modify somewhat the system of folding.

The usual custom in districts where crimson clover is grown is to hurdle on small areas of land a large number of sheep which bite and tread the heart out of the clover. No second growth results except on very good land, and under ideal conditions of growth. Even when a second crop does follow close folding, sheep will not eat it down a second time, though pigs will

The writer's method of folding is to use a combination of sheep netting and hurdles. For, say, a flock of 500 sheep, netting is placed round 10 acres in the form of an oblong 100 yards wide. The hurdles are placed crosswise at right angles to the long sides of the plot so as to enclose one or two acres. As the sheep eat down the plot, the cross hurdles are moved on, and the enlarged fold left for the sheep to wander over. As a result, after a few days' folding, instead of the sheep being confined to a small area, they have a considerable run of ground. The crop in consequence is not eaten down too bare, nor the land unduly trampled or soured.

Manuring of the Crop.—Quite a number of failures of crimson clover which have come before the writer's notice have been due to improper manuring of the crop. In fact, speaking generally, crimson clover is either insufficiently manured or not manured at all, yet there are few crops that will pay so well for a liberal dressing of artificials. It may also be stated that in the case of leguminous crops, there exists a very prevalent opinion that nitrogenous manures are not required. It is true that crimson clover, in common with other leguminous crops, has remarkable power of gathering free nitrogen from the atmosphere, but the writer's experience has led him to the very definite opinion that the discreet use of nitrogenous manures on nitrogen-gathering crops, by increasing the vigour of the crop, also increases the capacity for assimilation of nitrogen from the atmosphere.

It is very commonly known among farmers that clovers are nitrogen-gatherers, but very few farmers realise to what extent the growing of a clover crop enhances the fertility of the soil. In an article recently published Corrie emphasises the above point in an admirable manner. He states that :—

"The roots of one good clover crop in England (*i.e.*, the residue) were found to weigh when dried, 6,503 lb. per acre, and to contain 65 lb. nitrogen and 27 lb. phosphoric acid per acre. At Rothamsted, in an experiment comparing the effects of bare fallowing and cropping with clover, the following figures show the results obtained per acre throughout a rotation of swedes, barley, clover or fallow, and wheat :—

Plot.	*Clover Hay.*	*Wheat.*	*Swedes.*	*Barley.*
	cwt.	bus.	tons.	bus.
Clover Plot ...	76·7 ...	39·5 ...	19·4 ...	36·3
Fallow Plot ...	—— ...	32·5 ...	19·0 ...	28.3

Although nearly four tons of clover hay were removed, the residues or roots and stubbles were sufficient to increase the wheat crop by 21 per cent., the root crop by 2 per cent., and finally the barley, three years later, by 28 per cent."

Professor Neale, Delaware Experimental Station, states :—

"8·3 tons crimson clover, grown from seed which cost 4s. 2d. per acre, added 24 bushels to the corn crop ; 4s. 2d. invested in nitrate of soda and used as a top dressing added six bushels to the corn crop. It should be remembered also that the corn crop does not exhaust the whole of the nitrogen of the clover, whilst the nitrate of soda has no value after the one crop (and may even have an exhausting effect). None of the quick-acting nitrogenous manures will improve the texture of the soil, or supply organic matter. Often enough their use is harmful. The value of the legumes in the rotation should never be forgotten."

Another decided advantage of using nitrogen in the manuring of a mixture of crimson clover and Italian rye grass is that so doing ensures early feeding. On 6th March last the writer had two fields which were sown in autumn with a mixture of crimson clover and Italian rye grass. Field No. 1 at the time of sowing (late August) received a dressing of 1 cwt. Nauru phosphate, 2 cwt. superphosphate, and 2 cwt. kainit per acre. During the first week in February the crop received an additional dressing of 1 cwt. sulphate of ammonia and 1 cwt. nitrate of soda per acre. Field No. 2 was not manured in February. There was a good stand in both fields, but the February manured field was ready for folding off by the first week in April, whilst field No. 2 will probably not be ready until the first or second week in May. It might also be mentioned that since field No. 1 was previously cropped with corn, and No. 2 had had a tare crop consumed on the land, of necessity the latter field must have been in the better heart. Liberal manuring not only ensures a fuller and

an earlier first crop, but a more vigorous second crop where it is left for refolding, which in turn invariably results in a more vigorous follow-on crop. Another point well worthy of special mention is that liberal manuring, especially where nitrogenous manures are used, results in the crop remaining succulent for a longer period than an unmanured crop.

Generally speaking, a suitable dressing for crimson clover on a corn or vetch stubble is 3 cwt. superphosphate, 3 cwt. kainit, and ¾ cwt. sulphate of ammonia per acre. This manure should be applied at the time of sowing or as soon after as possible. Where a large area is sown for successional feeding it is a very good plan to give further dressings of nitrogenous manure—either nitrate of soda or sulphate of ammonia—in early spring. The first dressing might be applied about mid-February and the second and third at fortnightly intervals. There is a very prevalent opinion among shepherds that spring dressings of nitrogenous manures on crimson clover are apt to cause scour amongst the ewes and lambs. This opinion has some foundation, but the fault is not attributable to the use of artificial manures, but to the indiscreet use of the crop. Any succulent green crop will scour sheep if fed in excess, and without some corrective food in the form of hay or crushed oats mixed with a little cotton cake. Also the sheep should not be allowed to go on to a new fold of any kind of crop until the frost has cleared off.

Crimson Clover and Continuous Cropping.—Crimson clover is a crop which fits in well with the continuous cropping system which the writer has so long advocated. The crop can be introduced at various periods in suitable rotations, of which two examples will suffice. On one section of the farm the writer carries out the following rotation:—

1st year	...	1st crop	... Autumn cereals.
2nd ,,	...	2nd ,,	... Crimson clover and Italian rye-grass, autumn sown.
		3rd ,,	... Mixture of mustard, hardy green turnips, rye-grass and clover.
3rd ,,	...	4th ,,	... Seeds hay, aftermath grazed.
4th ,,	...	5th ,,	... Wheat with seeds.
5th ,,	...	6th ,,	... One year's ley.

In the above rotation the crimson clover and Italian rye-grass are folded off from April to the end of June, and as each section is fed off the land is immediately ploughed up and sown down with a mixture of from 10 to 12 lb. white mustard, 3 lb. hardy green turnips, 14 lb. Italian rye-grass and 4 lb. crimson clover.

per statute acre. The mustard crop keeps the land covered in until the hardy greens and grass seeds are established. During wet harvest weather the mustard is cut green and made into stack silage, then the hardy green turnips are fed off in the following spring time, and the rye-grass and clover seeds are hayed in late June, the aftermath from the latter crop being folded off and the land ploughed up for wheat.

Another continuous cropping rotation including crimson clover is as follows:—

1st year ...	1st crop ...	Autumn tares mixed on lea, folded off in early summer.
	2nd „ ..	Crimson clover and rye-grass, folded off in autumn.
2nd „ ...	3rd „ ...	Crimson clover and rye-grass, hayed or ensiled early summer. Hardy green turnips sown in rows, thinned out by harrows; small plants left.
3rd „ ...	4th „ ...	Small plants folded when bolted in spring.
	5th „ ...	Spring tare mixture and grass seeds. Former cut for hay in July.
	6th „ ...	Aftermath grazed.
4th „ ...	7th „ ...	Seeds hay.
	8th „ ...	Aftermath grazed.

* * * * * *

THE "RING-SPOT" AND "RUST" DISEASE OF LETTUCE.

E. S. SALMON and H. WORMALD,
Mycological Department, South-Eastern Agricultural College, Wye, Kent.

IN December last we received a number of lettuce plants from a farmer at Swanley, in Kent, with the information that whole fields of lettuce were being attacked by a disease which was rendering the plants unsaleable. Some of the specimens sent bore the two fungi commonly associated with disease in lettuce, viz., the Downy Mildew (*Bremia lactucae*) and the grey mould *Botrytis* (commonly called "mildew" by the grower), while one plant was affected by a bacterial rot. In addition, however, there were symptoms of a disease new to us, and this appeared to be responsible for the greater part of the damage done to the plants. An inspection of the fields was made, and the fact ascertained that while the *Bremia* and *Botrytis* were not causing an appreciable amount of harm, the new disease (*Marssonia panattoniana*, Berlese) was occurring on an epidemic

scale and was threatening the very existence of the lettuce-growing industry.

Description of the Disease.—The affected plants in the field are attacked on the leaf-blade and on the leaf-stalk. On the leaf-blade the disease is manifested by very characteristic perforations, each bordered by a white line. These perforations had attracted the notice of the grower and, very naturally, had led him to suppose that the plants were being attacked by some insect which was eating out minute holes in the leaf. This injury is, however, entirely the work of a fungus. The diseased areas on the leaf first appear as brown spots, having the appearance of being water-soaked; these usually soon become white with the spores of the fungus (*Fig. 1*). As the spots reach a diameter of $\frac{1}{8}$ in. or so, the central dead portions drop out, leaving the characteristic perforations (*Fig. 2*). The name "ring-spot" disease appears suitable to designate this form of injury which strikes the eye of the grower as he walks over the field.

When infection occurs on the midrib of the lettuce leaf (which takes place particularly on the underside and near the base) the spots instead of remaining circular, become elongated and form elliptical brown sunken patches (*Fig. 3*), at first sight giving the impression that the tissues have been eaten out by a slug. At these places the superficial layers of cells are killed and collapse and turn a rusty brown (which intensifies in colour after the lettuce plants have been packed), and thus blotches arise which render the lettuce unsaleable or greatly depreciate its market value. The name "rust" is used by the grower to designate this form of injury.

A microscopical examination showed that the white rim to the circular perforations on the leaves was due to the production of a mass of spores of the minute fungus, *Marssonia panattoniana*, which has not hitherto been reported from this country, except in a single instance in a glasshouse (see p. 149).* The same fungus was found producing its spores on the elliptical spots on the midrib. The spores are borne on short stalks which arise from a loose weft of fungal threads. The spores are colourless when seen singly, but appear white when seen in the mass; each is club-shaped, minute (about 15 by 3 μ) and divided by a cross-wall into two cells. They are produced in immense numbers, and when rain falls on the leaves it

* We are indebted to Miss E. M. Wakefield, at the Herbarium, Kew Gardens, for assistance in consulting the literature dealing with previous outbreaks.



FIG. 1.—Early stage of the "Ring-spot" condition: the spots are white with spores.

FIG. 2. Typical "Ring-spot" stage: the central portion of each spot has fallen out, leaving a perforation.

FIG. 3. The "Rust" stage, seen as brown, sunken, elliptical patches on the mid-rib. The brown patch at the base is caused by the fungus.

washes the spores down towards the crown of the plant and so the stalk portions of the leaves become infected, resulting in the withering of the older leaves and the infection successively of the younger ones.

Nature and Extent of Damage.—The grower stated:—"In the spring of 1922 there was no end of this trouble. I planted out 8½ acres of cabbage lettuce, and they are so badly attacked that we shall have to plough them in. . . . I have this year (1922) had upwards of 20 acres that has been practically valueless owing to this trouble. Five acres of Hardy Winter White Cos are now (February, 1923) becoming infested with the disease. During the year we grow, perhaps, 40 acres of lettuce. We do not as a rule use the same ground continuously for lettuce, though where we have done so we have found no ill effects until lately. The soil is loam, with good drainage. The varieties attacked have been 'Trocadero' (cabbage) and 'Lobjoits Green' and 'Hardy Winter White' (cos). I have not heard of the occurrence of the disease elsewhere than on my farm. I do not use boxes from salesmen, but sell all my own lettuce in my own boxes. I have had a lot of vegetable matter come in the rough dung I have from London. This is refuse cleared up from markets, etc. I have no doubt we have had lettuce in this that have been thrown away from some cause or other. I have an idea that this is where the disease has come from. Large quantities of lettuce are imported from France from early autumn until late spring and from Holland all through the spring while they pay to send."

No definite information is available as to the way the disease has been introduced into this country, but the fact that lettuces are imported from the Continent (where the disease exists) and that market refuse is carried out into the country for use as manure provides a very possible explanation.*

Circumstances attending Outbreaks of the Disease in other Countries.—The present disease has only once been previously reported in this country, viz., by Mr. F. J. Chittenden, in 1912,† on lettuce plants ("Early French Frame Forcing") in a glasshouse at Haslemere, Surrey, when "about a quarter of the crop" was attacked. A warning was given by Mr. Chittenden, that as the disease was likely, under certain conditions, to assume an epidemic form, a sharp watch for it should be kept by growers of lettuce. Mr. Chittenden informs us that no further cases have come to his notice.

* We have been informed by the Ministry of Agriculture that lettuces are imported into England from France, Holland and the Channel Islands.

† *Jour. Roy. Hort. Soc.*, Vol. XXXVII, p. 541.

The outbreak in Kent* is the first recorded case of the disease appearing on lettuces in the open in this country, and since growers in this country have had no experience of this fungus disease, the circumstances attending outbreaks of it in other countries are worth noting. The disease was first noticed† in Italy (in the neighbourhood of Pisa) in 1894, in the form of spots on the leaf-blade and depressions in the nerve of the leaf. The fungus causing the disease was found to be a species of *Marssonia* new to science. The disease was observed to start on the outer leaves, then to spread gradually to the innermost leaves of the "heart" of the lettuce, when the whole plant died. It was first noticed at the end of January; it continued to thrive throughout February and played havoc to the end of March. Several thousands of lettuce plants were destroyed in the gardens affected.

The next outbreak was reported‡ from Germany in 1907, although the investigations showed that the fungus had been in that country for some years previously, escaping observation and spreading little by little until the epidemic in 1907 took place. In the neighbourhood of Berlin the cultivation of lettuce was being carried out on a large scale for the Berlin market. At the height of the season 25 to 30 truck-loads of lettuce were sent in daily by railway to the market. The lettuce was sown in frames in November and December, and the young plants transplanted to the field as soon as possible in the first warm days in March. The same fields were used continuously for lettuce growing, and the remains of lettuce plants lay about on the soil and were dug in. Under these circumstances very favourable conditions obtained for an epidemic of the disease when the fungus reached the neighbourhood. Many growers lost several thousands of their plants: it was estimated that from 50 to 60 per cent. of the plants became affected, the earliest and most valuable part of the crop suffering most. Corresponding to the colder climate of Berlin, as compared with that of Pisa, the disease appeared later in the season, *i.e.*, in April, and continued to the end of May. Plants in the frames as well as in the open were attacked. In warm, dry weather those leaves of a plant which were already attacked

* Examples of the disease have now (April) been sent to us from Greenhithe, N. Kent.

† Berlese, A.N. Un nuovo marciume dell' Insalata (*Lactuca sativa*). Rivista di Patologia vegetale, III, 339 (1894).

‡ Appel, O. und Laibach, F. Arbeit. Kaiserl. Biol. Anst. f. Land- und Forstwirtschaft, Bd. VI, 1908. 28–37.

perished, but notwithstanding a saleable lettuce was produced; if damp weather came on, however, a further development of the fungus took place, and the disease assumed epidemic proportions. Even when the disease was limited to spots on outer leaves the lettuces suffered so much in general appearance that their market value was greatly lowered.

In 1899 the disease was reported by Oudemans,* from Holland (Nunspect), on lettuce, and also, in 1903, on endive. In 1915, Ritzema Bos recorded† the occurrence of the disease on endive in several localities in Holland, during October and November, 1914. In one case a crop of 5,000 plants was wholly lost.

In France the disease has been reported by Marchal and Foex,‡ from Châteaurenard-Provence (Bouches-du-Rhône), in 1913, but no details of the outbreak have been published.

The only other country in which the disease is known is the United States. It was found there first in 1895, in Ohio, and has since occurred in a few other States. It has been called various names in America, *e.g.*, "shot-hole," "leaf-perforation," "rust" and "anthracnose," and is not uncommon there as a greenhouse pest,§ but few epidemic outbreaks have been reported.

Control Measures.—No opportunity has yet existed in this country for ascertaining what measures for preventing or controlling the disease are practicable. The following information on the subject published by investigators abroad is worth noting:—As the disease is usually continued from the remains of a preceding diseased crop, a system of rotation should be adopted to eliminate this danger. Manure containing lettuce refuse should not be used. In the frame or greenhouse, watering should be carried out in a way to prevent the splashing of water from plant to plant or from leaf to leaf. As far as possible the beds should be inspected early and any diseased plant promptly removed and burnt, as one plant with the disease can become a centre of infection which may involve a whole bed

Spraying the plants (when young) with Bordeaux mixture or ammoniacal copper carbonate has been recommended, but does not appear to have been anywhere practised.

* C. A. J. A. Oudemans, in Nederlandsch Kruidkundig Archief, III serie, 2e deel, pp. 297 and 1117 (1902).

† J. Ritzema Bos, in Tijdschr. over Plantenziekten, XXI, 169 (1915).

‡ P. Marchal and E. Foex, in Annales du Service des Epiphyties, II, 32 (1915).

§ Brandes, E. W., Anthracnose of lettuce caused by *Marssonina panattoniana*. *Jour. Agr. Res.* XIII, No. 5. Apr. 1918, pp. 261–280. (References to previous outbreaks in the United States are given in this paper.)

POULTRY-KEEPING AT A FARM INSTITUTE.

R. E. LOUCH and W. B. MERCER,
Cheshire School of Agriculture.

POULTRY-KEEPING has many claims to be considered as a separate and distinct department of a farm institute. While the chief appeal of the farm institute as a whole must be to the farmer, and especially to the larger and more up-to-date farmer, the main bulk of the persons interested in poultry-keeping are not farmers at all or are farmers only of small areas. Students attending the farm institute may be expected to make very varying demands on the poultry department, according to their prospects and intentions in life. The "farming student"—the son of the larger farmer—may desire but a nodding acquaintance with the subject, but to others, poultry-keeping may be the chief concern in a course of instruction. Some indeed, if their requirements are fully met, will need a course in which poultry-keeping replaces agriculture.

Further, poultry-keeping as a subject of instruction can be, and needs to be treated from a standpoint different from that which the teacher of general agriculture commonly adopts. The immense changes in poultry-keeping practice during the past two decades have placed a great gulf between the older methods and the new; a gulf which many poultry-keepers have not as yet crossed.

It appears to us therefore that poultry-keeping is a subject in the teaching of which practical work and practical demonstration should be the keynote; and that an institution endeavouring to teach poultry-keeping should be equipped with an up-to-date department of reasonable size. A self-contained department possesses obvious advantages over a department consisting of a fragment or fragments of the farm, with a lien on portions of the farm buildings.

At the Cheshire School of Agriculture it has been possible to set apart a small dairy holding of about 5 acres (nearly all in grass) which lay in the Reaseheath estate within convenient distance of the hostel and laboratories. The land is divided by a high road into two crofts, the smaller of the two—some $1\frac{1}{2}$ acres—containing the smallholder's house, outbuildings and garden. The whole area is on light drift soil overlying New Red Sandstone.

Organisation.—In designing the lay-out we have been influenced by several considerations, viz. :—

1. While due regard must be paid to the expense both of equipment and of maintenance, a teaching department must be equipped in a manner which permits of good teaching. Provision must, for instance, be made for a much greater variety of work than would ordinarily be undertaken on a commercial place of the same size. Provision must further be made for instruction of a very varied nature—the resident student will need one thing, the casual visitor another.

2. Every live teaching institution must be equipped to carry out original work of some kind. While research in the present-day restricted meaning of the term is not usually considered as within the scope of work of a farm institute, provision must be made for investigations of a minor character. Poultry-keepers are in dire need of accurate statistical records in many departments of their business, and at least this type of work should be provided for.

3. A practical department must act as its own advertisement. It must be prepared for criticism from all sides. Not all of the people who visit farm institutes come to admire the places which public expenditure have called into being. Good stock and up-to-date plant are essential; and the premises must be kept presentable and clean beyond the real necessities of healthy life.

4. The place must be kept within the compass of the labour available. This fitting of the place to the labour, and *vice versa*, constitutes a great difficulty. Student labour is a very variable factor. Equally difficult to estimate is the absorption of a manager's time by appointed or casual visitors. Not only are there organised parties to cater for, but there are many small parties as well as small purchasers to reckon with. Few people buy a cockerel or a dozen chicks of a County Council poultry station without occupying the manager's time on one pretext or another for a considerable space. No commercial undertaking could afford to devote to casual purchasers the time which an educational institution must perforce spend on them. The value of the goods sold is too small. There seems no way out of this difficulty, though the difficulty is certainly minimised by making the station as far as possible self-explanatory.

Reaseheath station has been divided into sections as follows :—

1. Incubation and rearing (and table poultry production).
2. Varieties and breeding.
3. Commercial egg production.
4. Intensive management.
5. Ducks and other waterfowl.

The department at its inception took over a small flock, and a certain amount of plant which had been maintained on Henhull Hall Farm during the War for the purposes of the Egg and Chick Distribution Scheme. As soon as possession of the holding was obtained a poultry-man was appointed to live in the house, and to be responsible for the day to day manage-

ment of the station, under the superintendence of the County Poultry Instructor.

Incubation and Rearing.—The incubating room consists of a small cow-byre from which the stalls have been removed. It was necessary in adapting this building to relay the floor with concrete and to make certain small alterations to improve ventilation and lighting, but the whole of the adaptation was carried out for a comparatively small sum. Four types of machine—Hearson, Gloucester, Triumph and Glevum—are worked. The smaller machines, especially those taking only 100 eggs, prove much the most satisfactory for teaching purposes. Detailed records of the results obtained with the various machines and eggs at different dates are kept, and useful statistics are thus being collected.

The rearing section calls for little description. The newly-hatched chicks are transferred to brooders or hovers on grass immediately adjoining the incubator room. On leaving the brooders they are transferred to pens on cultivated land which occupy the remainder of the croft adjoining the poultryman's house. Later in the year these pens serve for accommodating surplus cockerels which are ultimately fattened.

Houses and Runs.—Twelve pens, each measuring about 20 yd. by 12 yd. have been laid out in line, along the roadside edge of the larger croft. The houses are arranged in pairs, and are of five patterns. While this variety of type militates to some extent against the appearance of the place, it possesses obvious educational advantages. Practically all the houses are directly accessible from the gangway. Trap-nests are fitted to most of these houses, and are being introduced into all. They are littered throughout with wheat straw, which possesses the advantages of durability and freedom from dust. In erecting the pens strong posts 5 to 6 in. square, with straining posts, were dug in at the corners of each pen, and 2 in. by 2 in. droppers of creosoted red deal were driven in at 10 ft. intervals. A galvanised iron straining wire was then fixed along the tops of the posts, and proved of material assistance in reducing buckling of the netting to a minimum. The runs were fenced with two 3 ft. widths of netting, the upper being of 3-in. mesh and the lower 2½-in. The upper width was put on first, and the lower width let into the turf to a depth varying with the surface of the ground. In hollow places, short lengths of appropriate width were fixed to the bottom of the lower strand. It might here be remarked that the deal

posts, creosoted under pressure and bought in bulk, were the same relative price as smaller quantities of uncreosoted material bought about the same time.

Varieties and Breeding.—We have had some difficulty in deciding on the number of breeds to be kept, as the needs of education and of economy in management to some extent clash. The breeds eventually decided upon were:—White Leghorn, Black Leghorn, White Wyandotte, Rhode Island Red, Light Sussex, Speckled Sussex and Ancona.

Commercial Egg Section.—One acre in the same croft has been wired in, and divided into two runs, for the purposes of this section. It was originally proposed to plough this area, but as grassland in the county is highly productive, and as, moreover, the relative possibilities of arable and grassland are being tried on a large scale in another department, the land has for the time being remained in grass, the two sections being grazed alternately. A large laying house, built from plans supplied by the Ministry of Agriculture and Fisheries,* occupies the centre of the area. This house is of the $\frac{3}{4}$-span type and embodies the ridge ventilation of the span roof, with all the advantages of the lean-to pattern. Of the 150 birds kept therein since it was put up 18 months ago, only one has shown any symptoms of cold, and the house has met with very general commendation from the large number of visitors who have inspected it. We have some confidence therefore in describing it as a very satisfactory house.

Some trouble was at first experienced from the burrowing of the fowls in the vicinity of the house, with consequent necessity for frequent patching. The difficulties incident on allowing birds to get under houses for this purpose are too well known to need description, and we have therefore sought another remedy in wiring round the bottom of the house with $\frac{1}{2}$-in. netting which is sunk in the ground to a depth of $1\frac{1}{2}$ ft. and by the provision of a small dust bath in each run. These baths have been made by digging out holes 2 ft. by 6 ft., and about 18 in. deep, bricking the sides and covering with a sheet of galvanised iron on four short posts. A barrow load of fresh sand has to be put in occasionally.

Intensive Management.—The variety pens and laying flock together occupy about two-thirds of the larger of the two crofts

* The following plans can be obtained from the Ministry:—No. 1, Laying house (11ft.); No. 2, House for 25 birds (or double breeding pen); No. 3, House for 6 to 9 birds; No. 4, Hen house ($8\times8\frac{1}{2}\times7\frac{1}{2}$ft.); No. 5, Duck house (18×10ft.). Price 3d. each, post free 4d. Set of 5 plans 1s. 3d., post free 1s. 6d.

of which the station consists. The remaining portion, about an acre in area, is wired round and in the latter part of the summer used for young stock at semi-free range. In the first half of the summer crop of hay is taken. A Hannaford house, 16 ft. by 10 ft., has recently been erected in the centre of this area, and will be used for intensive purposes during the growth of the hay crop. After the hay is removed it will be utilised for young stock. The Hannaford house is of the lean-to pattern, and built of 1 in. timber, but is otherwise similar to the large laying house already referred to.

Table Poultry Production.—The bulk of the cockerels reared are fattened on Sussex lines (the remainder being sold for stock purposes), and serve for the instruction of students in methods of killing, plucking and dressing.

Ducks and Geese.—A flock of White Runner ducks was added to the station last year, the birds reared on the rearing section, and at two months old transferred to a large ornamental lake in the gardens of the School of Agriculture. It might here be remarked that, while the natural conditions thus provided permit of ducks being reared cheaply—for they pick up a good deal of their living from the lake and adjoining shrubberies—it is, in our opinion, open to question whether the system is as satisfactory for purposes of egg production as more intensive methods. With so much natural food in the vicinity it is difficult to get the birds to eat as freely as could be wished of artificial rations provided for them, and a certain amount of difficulty in collecting eggs of birds at free range has always to be reckoned with.

A small flock of Canadian geese, also accommodated on the lake, forms an attractive feature of the department's stock.

Cost Accounting.—The question of cost accounting presents difficulties, due in part to the complexity of the station and in part to the necessity of entrusting students with the care of stock. The only possible way out of this difficulty would appear to be that of limiting enquiry to one section at a time, and for the present year we are restricting cost calculations to the large laying flock.

Courses of Instruction.—For the reasons indicated at the beginning of this article, it has been thought advisable to conduct, in addition to classes for students attending the general courses at the School of Agriculture, special short courses in poultry-keeping only. Two such courses commencing in January and April respectively, are now provided.

Co-ordination with County Work.—It may be of interest in conclusion to indicate the part which the poultry station plays in connection with the outside work of the School of Agriculture. One of the writers undertakes the whole of the peripatetic work in poultry-keeping in this county, and probably the greatest advantage which the county work as such derives from the poultry station lies in the intimate touch with practical affairs which the direction of the latter department enables him to maintain. It is of the greatest possible value in all county work to be personally concerned in the practical affairs of one's subject. By scarcely any other means can intimacy with markets and the ever-changing needs of the flock be maintained. Evening lectures and advisory work constitute the major part of the peripatetic work in this county. In the former department by far the most striking fact is the increasing number of people who manifest interest in the subject. Ten years ago audiences of fifteen to twenty could be reckoned good. To-day the average is over fifty.

Many casual factors influence the size of audiences at evening lectures, and it is difficult to argue with any confidence from the attendances at a few meetings. The averages for whole seasons, however, possess a fair degree of reliability, and judging by such averages in this county it would seem that urban and semi-urban areas led the way in the development of interest in the subject after the War, but that the rural districts are now ahead in this matter. In view of the relatively sparse population in the rural areas, the attendances in such areas are particularly striking.

It is further noteworthy that movements for the formation of poultry societies, formerly most noticeable in urban districts, are now making considerable headway in the rural areas also—though whether the educationist is to regard such movements as cause or effect it is difficult to say.

Advisory work is naturally of a very varied nature and only two features call for special mention. Noteworthy in the first place is the increasing number of poultry-keepers who ask for advice on and assistance in grading of stock. It is plain that selection of breeding stock is generally receiving more attention than heretofore. A second feature of note is applications for "hospital treatment" of special birds. We have had so many requests for such advice that the provision of a hospital section in the department has been considered. There are, however, difficulties almost needless to describe. Foods and feeding are of course a perennial source of inquiry.

HOARY PEPPERWORT OR THANET WEED.

G. H. GARRAD, N.D.A.,
Agricultural Organiser for Kent.

THE weed (*Lepidium Draba*, L.) which is known in Essex and Kent under the names of Whitlow Pepperwort, White Weed, Chalk Weed, Thanet Weed, Devil's Cabbage, Hoary Pepperwort, or Hoary Cress, has been described and illustrated in an article written by Mr. R. Robson which appeared in this *Journal* in April, 1919. It is a weed that has done an enormous amount of damage in Thanet and in North Kent during the past few years, and as it is gradually spreading from East Kent and from East Essex westwards, farmers should be on the look out for it so that they may be able to deal with it directly it appears on the farm before it has established itself.

This weed is a perennial, with creeping roots resembling those of bindweed. When it first appears on a farm as an isolated patch it is possible to deal with it by forking it out by hand. Once it has established itself over a large area, however, it is one of the most difficult of weeds to deal with because it spreads very rapidly by means of its underground roots, as well as by seed, and the roots run so deep down in the ground that it is impossible to reach them all with a plough. It flowers from May to June.

In this *Journal* for April, 1919, Mr. Robson related his endeavours to control this weed by spraying with copper sulphate. The results of his efforts in 1918 were encouraging, and his work was made the starting point of further spraying trials in Kent which will now be described.

Trials in 1921.—The first trials were made in 1921 on a field of wheat, badly infested with the weed, belonging to Mr. G. Reeves, Chestfield Manor Farm, Whitstable. On 22nd April two plots, each one-tenth of an acre in extent, were sprayed with copper sulphate as follows:—

Plot 1. At the rate of 14 lb. of copper sulphate and 56 lb. nitrate of soda dissolved in 70 gal. of water, per acre.

Plot 2. Unsprayed.

Plot 3. At the rate of 32 lb. of copper sulphate dissolved in 80 gal. of water, per acre.

The day on which the spraying was done was fine and dry, but two wet days followed. Nevertheless, when the plots were inspected a week later, it was found that although the wheat was slightly burned the results were eminently successful, the weed

on both sprayed plots being very much browned and scorched. It was originally intended to spray one-half of each plot a second time, and they were visited on 13th May for this purpose but it was found that there was practically no live weed to spray. The wheat had completely recovered whilst the weed had become considerably more shrivelled and brown, especially on Plot 3. It was noticed, however, that close to the ground a few fresh shoots were springing from the old stems below the ground. The wheat by this time was 20 in. high whilst these new shoots were not more than an inch above the ground, so it was impossible to deal with them. The field was cut on 21st July, and an inspection on that day showed a marked difference between the two sprayed plots and the unsprayed plot. The crop on the unsprayed plot was thinner and not so tall, the thick growth of the weed having suffocated the crop. The yield on the unsprayed plot was obviously much less than on the sprayed plots. On the remainder of the field the weed had been hand pulled by casual labourers from Whitstable at an estimated cost of £2 14s. per acre.

Trials in 1922.—The results of the 1921 trial were so encouraging that it was decided to carry out a large number of trials in 1922.

The first experiment was designed to try the effect of spraying when the weed was young. Mr. A. Montgomery, Nash Court, Margate, offered a field of winter barley, and twelve plots, each one-twentieth of an acre, were sprayed between 25th April and 2nd May, when both the weed and the winter barley were about 8 in. high. Copper sulphate alone was used in different strengths, and varying quantities of the spray were applied per acre. Copper sulphate was also tried as a dry spray. Sulphate of ammonia was experimented with in two different strengths, and mixtures of copper sulphate with nitrate of soda and of copper sulphate with sulphate of ammonia were tried. In all cases the results were unsatisfactory. This was partly owing to the fact that the weather was very showery so that much of the spray was washed off, but principally because the weed was too young. The leaves of the weed were killed but a fresh growth shot out from the terminal buds, and by the end of June this new growth had produced flowers and begun to seed. The result resembled what happens when thistles are cut too early in the season. A second spraying was attempted on one-half of each of five of the plots on 19th May, but this seriously damaged the winter barley crop, the loss being estimated at three sacks of corn per acre.

It is possible that winter barley is more liable to damage by spraying than other cereals, but in any case the early spraying was a failure. Nor does there seem much likelihood of dry spraying being successful. Rain fell for about five minutes at 8.30 a.m., three hours after the dry spraying was done, and this may have washed some of the powder off the leaves, but it was noticed at the time of spraying that the powder would not adhere satisfactorily to the weed.

Sets of four plots, each one-twentieth of an acre in extent, were now laid down on five different farms and sprayed on the following dates:—

Messrs. Piggot Bros., Elmwood Farm, Minster	22nd May.
Capt. Hatfeild, Hartsdown Farm, Margate.	23rd „
Mr. A. W. Miller, Monkton Road Farm, Birchington.	24th „
Mr. J. Sayer, Cheeseman's Farm, Minster.	26th „
Mr. R. S. Vinson, Walter's Hall Farm, Monkton.	27th „
Mr. J. Read, Hundred's Farm, Westgate.	29th „

In every case four plots were sprayed as follows (all per acre):—

Plot 1. 32 lb. of copper sulphate in 80 gal. of water.
Plot 2. 2 cwt. of sulphate of ammonia in 60 gal. of water.
Plot 3. 14 lb. of copper sulphate and 56 lb. of nitrate of soda in 70 gal. of water.
Plot 4. 14 lb. of copper sulphate and 56 lb. of sulphate of ammonia in 70 gal. of water.

The weather was hot and dry at the time of spraying of all the plots, and no rain fell afterwards for at least a fortnight.

The most successful results were obtained on Messrs. Piggott's farm, where the crop was young lucerne sown the previous autumn. The weed was sprayed when in full flower. The young lucerne was not damaged, but the weed was effectively dealt with on all plots, especially on Plot 1. The weed was so thick, however, that the quantity of spray used proved to be insufficient to reach every plant.

On the other four farms the crop was wheat, about 12 in. high at the time of spraying. The chalk weed was about the same height and in flower. Where the crop was thick so that it sheltered the weed the effect of the spraying was disappointing, and the best results were obtained where the corn crop was thin. There was little to choose between the efficacy of the different sprays used, but in most cases the mixture of copper sulphate and nitrate of soda was the least efficacious.

On 30th May a field of spring oats was offered for experimental purposes by Mr. G. Reeves, Chestfield Manor. Whits-ble.

Seven plots were set out, each one-fortieth of an acre in extent, and sprayed as follows (per acre) :—

Plot 1.	32 lb.	of copper sulphate	in	80	gal. of water.
„ 2.	32	„	„	100	„
„ 3.	32	„	„	60	„
„ 4.	40	„	„	80	„
„ 5.	40	„	„	100	„
„ 6.	24	„	„	60	„
„ 7.	24	„	„	80	„

The crop was 12 to 15 in. high at the time of spraying and the flowers of the weed were beginning to fall. Plots 6 and 7 were a failure, the amount of copper sulphate being evidently too small. The results on Plots 1, 2 and 3 were all very similar, fairly effective, but not so effective as on Plots 4 and 5. Plot 4 was slightly superior to Plot 5, which was one of the most effectively sprayed plots in the whole year's set of trials. The spring oats were not seriously damaged on any of the plots.

On 6th June further plots were set out and sprayed as follows (per acre) :—

Plot 8. 48 lb. of copper sulphate in 120 gal. of water.
„ 9. 3 cwt. of sulphate of ammonia in 90 gal. of water.
„ 10. 20 lb. of copper sulphate and 84 lb. of sulphate of ammonia in 105 gal. of water.
„ 11. 32 lb. of copper sulphate and 13 oz. of saponin (to act as a spreader) in 80 gal. of water.

Plot 9 seemed to be the most effective, Plots 8 and 10 being very similar to Plots 4 and 5. On Plots 9 and 10 the spring oats were rather badly scorched and some stray plants of wheat suffered even worse. The effect of saponin as a spreading agent needs further trial.

General Conclusions.—It must not be expected that a single year's spraying will kill the deep underground roots of this plant, but it will prevent the smothering of the corn crop and it will weaken the plant. No plant can live indefinitely without leaves, and if the spraying treatment is persisted in there is every hope that the weed will gradually become less troublesome. Further experiments will be carried out in 1923. As a result of the trials the following conclusions have been tentatively drawn :—

1. Spraying before the weed is fully grown seems ineffective. The leaves of the plants are killed but the stems throw out a fresh growth. The most effective time to spray seems to be when the plant is in flower.

2. The following sprays are all fairly effective in destroying the leaves and stems if used when the plants are in flower :—

(*a*) 40 lb. of copper sulphate in 80 gal. of water.
(*b*) 2 cwt. of sulphate of ammonia in 60 gal. of water.
(*c*) 14 lb. of copper sulphate and 56 lb. of sulphate of ammonia in 70 gal. of water.

3. There is evidence to show that the plants should be hit with some force.

4. The spraying seems to be more effective if it is done on a dull dry sunless day rather than on a hot sunny day.

5. The spraying is most effective where the weed stands up well above the corn in which it is growing. If the corn is strong and protecting the weed, spraying is decidedly less effective.

6. Dry spraying has not proved effective.

7. Twice spraying damages the winter barley crop.

8. The spraying does not damage young lucerne.

9. The various sprays used have had no effect on bindweed or nettles, and very little effect on poppies or thistles.

10. The sulphate of ammonia spray shows its results very quickly and causes the leaves to turn a distinct light brown colour. It kills plants very thoroughly where they get a full dose. Sulphate of ammonia will also exert a manurial effect on the crop after rain has fallen.

11. Copper sulphate takes about a fortnight to show its full effect. It causes the leaves to turn a dirty green colour, which does not catch the eye so much as the effect obtained with sulphate of ammonia, but the leaves become quite brittle and then fall off the stems.

Note.—The spraying was carried out by Mr. T. W. Mc. D. Porter and acknowledgments are due to him, to Mr. W. M. Ware, Assistant Botanist at Wye College, who has taken much interest in the trials, and to all the farmers who gave the facilities for carrying out the experiments.

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HORTICULTURE IN THE ISLES OF SCILLY.

B. L. WOLF and A. D. R. WALBANK.

SOME forty miles distant from Penzance, along the wet highway that stretches from the Cornish Harbour to the Port of St. Mary's, lie what we may term the lovely Gardens of the Atlantic—the Isles of Scilly. Five islands of this group of some fifty rocky prominences are peopled with a sturdy race of industrious workers.

Although but tiny specks on the map of the world, St. Mary's, Tresco, St. Martin's, St. Agnes and Bryher, each is a veritable hive of industry of such a character that a brief outline of the inhabitants' activities may be of interest.

St. Mary's, the main island of the Scillies, is about nine miles in circumference, and has a population of about 1,200. The soil is typical of that to be found on the other inhabited islands in the group—a light sandy loam, varying in depth from a few inches to just over three feet. The average rainfall is approximately 30 in. per annum; the winter temperature averages 47 degrees Fahrenheit, the summer around ten degrees higher. The nature of the soil and climatic conditions are such that growth is hardly ever checked, even in the depth of winter. Owing to the smallness of some of the holdings, the cultivation of the soil alone will not suffice for the occupier to support his family; in these cases fishing is an added occupation.

The main industry in the Scilly Islands is flower production. Early potatoes form an important side line, and bulbs are also exported. The approximate tonnage of flowers and potatoes taken from the Islands to the mainland in the Scillies' own steamer, indicates the relative importance of these two crops. In 1922 some 790 tons of flowers were exported (in 1921 about 1,000) and just over 600 tons of early potatoes. The former amount represents, say, four and three-quarter million bunches! The bulk of these are narcissi—the well-known Soleil d'Or, Gloriosa, Poeticus ornatus, Scilly White, and Grand Primo, with Golden Spur, Princeps, and other trumpets that find favour in our markets.

Flower Growing.—The more sheltered parts of the islands are devoted to the cultivation of flowers, and even on some of the exposed parts an attempt is being made to grow them. Flowers seem to meet the eye at every turn. In the windows of the cottages, in tiny parcels of land tucked away in some out-of-the-way corner where one would not expect a flower could grow, in the meadows, the cultivated fields—flowers! Arum lilies, grown in the open, stocks, wallflowers, anemones, violets and narcissi—all these are cultivated—but the narcissus holds the front rank in the export trade and in the hearts of the horticulturists of the Scillies.

Wind is the bane of the narcissus cultivator. For this reason many of the fields are split up into a number of tiny patches by means of live hedges, formed of such shrubs as Euonymus,

Veronica and Escallonia, which flourish in the islands; or wind breaks may be provided by the more modern method of combined wood and rush shelters. In addition to the favourite popular varieties referred to, some of the more recent introductions are being tried, including E. M. Berkeley and Harold. It is said that no bulb of the varieties Scilly White and Soleil d'Or has ever been imported into the islands. The flower industry has grown up from the humble beginning made with a few bulbs of these two sorts which were dug out from the hedgerows and given congenial accommodation in a sheltered garden.

The size of the holdings varies from 3 to 4 acres up to the rare figure of 60 acres. On well cultivated farms it is customary to allow the bulbs to remain for three years; they are then lifted, sorted into sizes and replanted in fresh fields. In others bulbs remain in the same beds for a number of years—and need it be added, some of the soils seem sick of providing a house for them? The subsequent treatment of the land is referred to in connection with the early potato industry. The early flowers are picked when the buds are breaking and taken inside to open. They are then put in bunches and marketed in non-returnable boxes made by the growers themselves. On an average 30 bunches are packed in each box, but, unfortunately, there are often far too many blooms crowded into the boxes in which they have to travel to Covent Garden and the large provincial markets of England and Wales.

Glass houses used to be more generally used for forcing than is the case now, but a few of the growers are renovating or rebuilding their glass houses. The largest area under glass is at Tresco, where over 50,000 sq. ft. of glass are in constant service. Flowers, potatoes followed by tomatoes, with mint as a catch crop, is the order of the cropping each year in these houses.

Bulb Exports.—Although something like 180 tons of bulbs were exported from the islands during the year 1922, bulb production for export has not yet been engaged in to any extent. That wonderfully good bulbs are grown here none will gainsay; their presence points to great possibilities if this branch of the narcissus industry can be developed. With limited space at disposal, however, some difficulty has been experienced by the smaller growers in obtaining for planting land which has not recently carried a crop of narcissi. The result is that bulbs occupy so much of the available area that

there is insufficient break to ensure the elimination of the variety lifted before another sort goes in. Purity of stocks can then only be attained by resort to rogueing. There are other factors to be considered, but it cannot be too strongly emphasised that purity of stocks must be maintained if a successful trade in bulbs is to be achieved. It would appear that for the satisfactory development of this branch of the narcissus industry, a systematic rotation of crops is essential. There is need for more land, but there is very little more to be had.

From the nature of the soil and the climatic conditions obtaining, it would seem that flowers other than the narcissus might offer a solution of the problem. It is highly probable that there are remunerative lines which might be taken up whilst the soil is resting from the daffodil. The facts could be ascertained by the establishment of trials on the islands themselves.

Early Potato Growing.—Although looked upon as a side line, the importance of this crop may be noted by the figure of 600 tons given as the approximate total of early potatoes exported during the year 1922. Before 1922 the crop was out of favour for some seasons, but it is now receiving more attention. A comparison of narcissus and early potato production is interesting: an islander has given it in his own words:—"A bad crop of flowers is better than a good crop of potatoes." This may be so, but it depends upon the farm on which the potatoes are grown. Opinion is divided as to the wisdom of further increasing the area, and in all probability this is due to wide variations in the degree of suitability of the sites available for the purpose on different farms. Where the crop can be lifted and marketed by mid-April a good price is usually secured. On the other hand, some of the growers cannot lift before the second week in May.

Dargill Early, under the name of Advance, is the prime favourite—in fact it is practically the only first early grown. Fresh seed is imported each year from Lincolnshire. In many cases earlies are only grown for the purpose of giving the land a rest from the bulbs, "without losing very much money by doing so," it is said. The preparation of the soil includes a very heavy dressing of seaweed, drawn from the beach and spread straightway over the surface and ploughed in. The tubers are boxed and sprouted before planting. The usual distance apart is 10 in. by 10 in. The practice on St. Mary's is

to plant on New Year's Day, but there are exceptions to this date in some parts of the island. Many in St. Martin's and Tresco plant just before Christmas. The early potatoes are followed by a root crop, such as mangolds, swedes or carrots. A few growers in the second year follow the potatoes with a straw crop, a mixture of grass seeds being sown with it, and the seeds are allowed to remain for the third year, after which the land is broken up and prepared for bulbs.

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MONTHLY NOTES ON FEEDING STUFFS.

E. T. HALNAN, M.A., Dip. Agric. (Cantab.),
Ministry of Agriculture and Fisheries.

THE Agricultural Organiser for Northamptonshire, Mr. W. A. Stewart, has recently tried several feeding stuffs not in common use. The results of his observations are sufficiently interesting to merit notice here, and are as follows :—

Chocolate Meal.—With care this material can be used safely with all classes of cattle and pigs. It may be decidedly harmful if used in excess. Up to 1 lb. per head for adult cattle and up to ½ lb. per head per day for young stock may be given. It is useful as an appetiser when fed with inferior hay and straw or chaff. With regard to pigs, up to 10 per cent. of the ration may be used with good results, but it is not suitable for admixture with fish meal.

Dried Yeast.—Dried yeast can be used up to ½ lb. per gallon of milk for cows, and 1 lb. per head per day for young stock. It has a slightly bitter taste, and a little difficulty may be experienced at first in getting the stock to eat it. Dried yeast should not be mixed in a ration containing sugary material such as treacle or chocolate meal.

Mineral Requirements of Dairy Cows.—The work of Forbes and others has called attention to the fact that under normal agricultural conditions a heavily milking cow often shows a negative balance for both calcium and phosphorus, but particularly calcium. That is to say, more calcium and phosphorus leave the body in the form of excreta and milk than are supplied in the ration. It has been shown that this condition of negative balance is more likely to occur when the forage is fed in a cured state, *i.e.*, in the form of hay. In the case of dry cows, Forbes'

DESCRIPTION.	Price per Qr.		Price per Cwt.	Price per Ton.	Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit, Starch Equiv.	Price per lb. Starch Equiv.
	s.	lb.	s.	£ s.	£ s.	£ s.		s.	d.
Wheat, British	44/6	504	9/11	9 18	0 18	9 0	71·6	2/6	1·34
Barley, British Feeding	28/0	400	7/10	7 17	0 14	7 3	71	2/–	1·07
,, Danubian ,,	31/–	,,	8/8	8 13	0 14	7 19	71	2/3	1·20
,, Persian ,,	27/–	,,	7/7	7 12	0 14	6 18	71	1/11	1·03
Oats, English White	30/0	336	10/–	10 0	0 16	9 4	59·5	3/1	1·65
,, Black & Grey	28/0	,,	9/4	9 7	0 16	8 11	59·5	2/10	1·52
,, Scotch White	36/–	,,	12/–	12 0	0 16	11 4	59·5	3/9	2·01
,, Canadian No. 2 Western	30/6	320	10/8	10 13	0 16	9 17	59·5	3/4	1·78
,, ,, No. 3 ,,	28/9	,,	10/1	10 2	0 16	9 6	59·5	3/2	1·70
,, ,, Feed	27/3	,,	9/6	9 10	0 16	8 14	59·5	2/11	1·56
,, American	26/3	,,	9/2	9 3	0 16	8 7	59·5	2/10	1·52
,, Argentine	26/3	,,	9/2	9 3	0 16	8 7	59·5	2/10	1·52
Maize, Argentine	40/–	480	9/4	9 7	0 15	8 12	81	2/1	1·12
,, American	38/6	,,	9/–	9 0	0 15	8 5	81	2/–	1·07
Beans, English Winter	46/6	532	9/9	9 15	1 18	7 17	67	2/4	1·25
,, Rangoon	—	—	8/11	8 18	1 18	7 0	67	2/1	1·12
Peas, English, Dun	58/–	504	12/11	12 18	1 13	11 5	69	3/3	1·74
Millers' offals—									
Bran, British	—	—	—	7 2	1 11	5 11	45	2/6	1·34
,, Broad	—	—	—	8 5	1 11	6 14	45	3/–	1·61
Fine middlings (Imported)	—	—	—	9 0	1 6	7 14	72	2/2	1·16
Coarse middlings (British)	—	—	—	7 5	1 6	5 19	64	1/10	0·98
Pollards (Imported)	—	—	—	6 7	1 11	4 16	60	1/7	0·85
Barley Meal	—	—	—	9 12	0 14	8 18	71	2/5	1·34
Maize ,,	—	—	—	10 5	0 15	9 10	81	2/4	1·25
,, Germ Meal	—	—	—	9 0	1 2	7 18	85·3	1/10	1·98
,, Gluten-feed	—	—	—	9 0	1 12	7 8	75·6	1/11	1·03
Locust Bean Meal	—	—	—	8 0	0 11	7 9	71·4	2/1	1·12
Bean Meal	—	—	—	12 5	1 18	10 7	67	3/1	1·65
Fish ,,	—	—	—	17 2	5 0	12 2	53	4/7	2·45
Linseed	—	—	—	21 0	1 16	19 4	119	3/3	1·74
,, Cake, English (9% oil)	—	—	—	12 0	2 5	9 15	74	2/8	1·43
Cottonseed Cake, English (Egyptian Seed) (5½% oil)	—	—	—	7 10	2 0	5 10	42	2/7	1·38
,, ,, Egyptian (5½% oil)	—	—	—	7 6	2 0	5 6	42	2/6	1·34
Coconut Cake (6% oil)	—	—	—	8 5	1 15	6 10	73	1/9	0·94
Palm Kernel Cake (6% oil)	—	—	—	7 0*	1 7	5 13	75	1/6	0·80
,, ,, Meal (2% ,,)	—	—	—	5 10	1 8	4 2	71·3	1/2	0·62
Feeding Treacle	—	—	—	4 0	0 9	3 11	51	1/5	0·76
Brewers' grains, dried, ale	—	—	—	7 17	1 8	6 9	49	2/8	1·43
,, ,, ,, porter	—	—	—	7 10	1 8	6 2	49	2/6	1·34
,, ,, wet, ale	—	—	—	1 13	0 11	1 2	15	1/6	0·80
,, ,, wet, porter	—	—	—	1 9	0 11	0 18	15	1/2	0·62

* At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of March and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 15s. per ton. The food value per ton is therefore £8 5s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 3d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·21d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 15s. 5d.; P_2O_5, 4s. 6d.; K_2O, 2s. 10d.

results showed that the rations fed usually supplied more calcium and phosphorus than were required, and the excess was stored in the body. As far as the scientific side is concerned, our knowledge on the subject is still incomplete, but sufficient is known to indicate the steps that farmers should take to supply the mineral requirements of milking cows, particularly during the winter period when fresh grass is not available.

Generally speaking, the phosphorus needs of the cow are supplied in an ordinary mixed ration in American practice, but the calcium needs were rarely supplied when a large quantity of lucerne hay was supplied in the ration. In English practice, the best method of supplying this deficiency is to include leguminous hay, such as clover hay, lucerne and sainfoin hay, or pea and oat hay, in the roughage fed during the winter period.

Use of Milk for Calves.—In an experiment carried out by Andrew C. McCandlish at Iowa, an attempt was made to raise two bull calves on a diet consisting wholly of milk. The results are of practical interest in that they emphasise the fact that milk is only an ideal food for young stock for a limited period. In the experiment in question, no roughage, water or grain was given to the experimental animals, which grew satisfactorily until two or three months old. From this period onward they did not thrive, and eventually death occurred. The author suggests that the lack of bulk of the ration, the possible deficiency of water-soluble B and C vitamines, and excessive consumption of salt, may have been the contributory causes leading to the emaciation and subsequent death of the calves.

FARM VALUES.

CROPS.	Value per Ton on Farm. £ s.	Manurial Value per Ton. £ s.	Food Value per Ton. £ s.	Starch Equivalent per 100 lb.	Value per unit S.E. s. d.	Market Value per lb. S.E. d.
Wheat	8 1	0 18	7 3	71·6	2/0	1·07
Oats	6 15	0 16	5 19	59·5	2/0	1·07
Barley	7 16	0 14	7 2	71·0	2/0	1·07
Potatoes	2 0	0 4	1 16	18·0	2/0	1·07
Swedes	0 17	0 3	0 14	7·0	2/0	1·07
Mangolds	0 15	0 3	0 12	6·0	2/0	1·07
Good Meadow Hay	4 19	0 16	4 3	31·0	2/8	1·43
Good Oat Straw	2 13	0 8	2 5	17·0	2/8	1·43
Good Clover Hay	5 9	1 4	4 5	32·0	2/8	1·43
Vetch and Oat Silage	2 1	0 8	1 13	11·0	2/4	1·25

* * * * * *

PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending April 11th.*				Cost per Unit at London
	Bristol	Hull	L'pool	L'ndn	
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	14. 0	14. 5	13. 10	13. 2	16.11
,, ,, Lime (N. 13 per cent.)	...	...	...	12. 7	19. 0
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	16. 0*	16. 0*	16. 0*	16. 0*	(N)15. 5
,, ,, ,, neutral (A. 25¾ per cent.)	17. 3*	17. 3*	17. 3*	17. 3*	(N)16. 2
Kainit (Pot. 12½ per cent.)	...	..	...	2. 0	3. 2
,, (Pot. 14 per cent.)	2. 5	2. 1	2.10	2. 7	3. 5
Sylvinite (Pot. 20 per cent.)	...	...	...	3. 0	3. 0
Potash Salts (Pot. 30 per cent.)	...	...	...	4. 5	2.10
Muriate of Potash (Pot. 50 per cent.) ...	9.10	7.15	8. 0	8. 0	3. 2
Sulphate of Potash (Pot. 48 per cent.) ...	...	12.15‡	11.15	11.15	4.11
Basic Slag (T.P. 30-32 per cent.)	3.12§	...	...	3.15§	2. 5
,, ,, (T.P. 26 per cent.)	...	2.12§	...	...	...
,, ,, (T.P. 24 per cent.)	...	2. 8§	2. 7§	...	...
,, ,, (T.P. 20-22 per cent.)	2.10§	2. 5§	...	2.12§	2. 6
,, ,, (T.P. 16-18 per cent.)	2. 0§	...	2. 0§	2. 8§	2.10
Slag Phosphate (T.P. 60 per cent.) ...	6. 7†	...	..	6.15§	2. 3
,, ,, (T.P. 50 per cent.) ...	...	...	...	5.15§	2. 4
,, ,, (T.P. 40 per cent.) ...	1. 7†	...	...	...	...
Superphosphate (S.P. 35 per cent.) ...	4. 7	...	4. 5§	4. 0	2. 3
,, (S.P. 30 per cent.) ...	3.17	3. 7	3.15§	3.12	2. 5
Bone Meal (T.P. 45 per cent.)	9.10	9.10†	9. 5	8.12	...
Steamed Bone Flour (T.P. 60 per cent.) ...	8.10†	7.10†	7. 0	6.17	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12. 5	13. 7	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ At Goole.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works. ‡ At Goole.

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Test of Second Growth Potatoes for Seed.

THE following note has been communicated by Professor R. G. White and Mr. E. J. Roberts, of the Department of Agriculture, University College of North Wales, Bangor:—

In 1921 second growth occurred to a great extent among potatoes, particularly those varieties possessing a vigorous type of growth, Kerr's Pink being one of the kinds mostly affected. Many experienced growers expressed doubt as to whether the tubers which had grown out would be of value for seed, but from many quarters recommendations were made advising the selection

of the secondary tubers for seed purposes. The opinion was generally held that such tubers would be more or less immature and of special value for the purpose.

In order to test this point a plot of Kerr's Pink at the farm of the University College of North Wales at Aber, in which second growth had occurred to a great extent, was carefully lifted by hand, and pairs of tubers, first and second growth respectively, were selected for seed purposes. Only those tubers were taken in which the connection remained unbroken, so that each second growth tuber planted in 1922 in the one plot had its counterpart in the plot planted with first growth tubers. In order to test how far any difference obtained was due to immaturity of seed two such double lots of seed were lifted, the first on 26th September, when the crop was still quite green and growing vigorously; the second on 29th October, when the tops had died down, and the crop was judged to be ripe for lifting. Sufficient seed of each kind was taken to plant in 1922 a plot of one-thirtieth acre. All the seed was boxed immediately after lifting and planted on 11th April, 1922.

The results obtained in 1922 are given in the following table:—

Date of lifting seed potatoes	Nature of tubers	Weight of crop per acre 1922			
		Marketable	Small	Diseased	Total
		t. cwt. lb.	t. cwt. lb.	t. cwt. lb.	t. cwt. lb.
26th September, 1921 ...	1st growth	9 19 28	0 17 28	0 3 84	11 0 28
do. ...	2nd growth	10 0 28	0 16 0	0 2 84	10 19 0
29th October, 1921 ...	1st growth	10 0 0	0 19 56	0 2 84	11 2 28
do. ...	2nd growth	8 7 56	1 4 84	0 2 28	9 14 56

It is clear that the first growth tubers were in no way inferior as seed to the second growth tubers. The two lots of seed lifted on 26th September gave the same result. In the case of the seed lifted at the end of October the second growth tubers gave an inferior result.

These results are very different from what was expected, but the experiment was conducted with such care that we have every confidence in publishing them, and as it is only rarely that second growth occurs to such an extent as to enable the experiment to be repeated, they are now given in the hope that the matter will be further investigated elsewhere when possible.

* * * * * *

Variety of Potato immune from Wart Disease.

In the report on the Wart Disease Immunity Trials carried out at Ormskirk in 1922 (see this *Journal*, March, 1923), it was stated that in addition to the varieties mentioned therein, the Ministry was prepared to add certain seedlings to the official list of approved immune varieties when they had been named.

One of these seedlings has now been named "Norna," and it has accordingly been added to the official list. The following is a description of this variety :—

Late or Maincrop Variety.

(1) *Sprout.*—Bright red.

(2) *Tuber.*—Oval; skin white; flesh white; eyes shallow.

(3) *Haulm.*—Upright to spreading, somewhat straggling; leaflets light green, small corrugated, glossy, drooping, involute; leaf open.

(4) *Flowers.*—None observed.

* * * * * *

Clean Milk Competitions.

"CLEAN MILK" is now regarded as a national necessity and dirty milk as a national menace. The difference between clean milk and dirty milk is the difference between carefulness and carelessness on the part of those concerned—producer, cowman, and retailer. Milk has long been recognised as a valuable food in the home—the best possible food for the young—but the importance of securing milk of a clean, safe, and wholesome quality has not yet received the attention which it so emphatically deserves. In this connection it should be noted that actual results have proved that milk of high hygienic and good keeping quality can be produced in the average cowshed at very little additional cost, provided careful methods be adopted. Increasing attention is being given to this subject by certain Local Agricultural Education Authorities, and notes have appeared from time to time in this *Journal* giving particulars of clean milk competitions organised by such Authorities and by firms engaged in the milk trade.

There is at present a Clean Milk Competition in progress in Essex, and a similar competition held in Kent terminated in the middle of April.

Essex Competition.—The Essex competition, which started on 1st February and will continue until the 30th June next, has, as in previous years, been organised by the Essex Agricul-

tural Society with the co-operation of the East Anglian Institute of Agriculture. The following are the conditions of this year's competition in Essex.

The competition is open to county residents and occupiers. Surprise samples (not exceeding 6 in number) are taken at the farms. Competitors must also send 6 samples taken from a full churn of milk immediately after cooling on stated days. The churns and other utensils are examined for bacterial contamination.

Herds are inspected by a veterinary surgeon once during the competition and a certificate is awarded. The veterinary surgeon's report is sent direct to the judges at the East Anglian Institute of Agriculture, Chelmsford.

Class A. Tuberculin Tested Herds.—Ten or more cows in milk. A diploma is awarded to each competitor who, in the opinion of the judges, produces milk of a sufficiently high hygienic quality. £5, £4, £3, £2 and £1 are given in prizes, together with a certificate to the milkers. Second prize will be awarded if three or more entries, and the third prize if five or more entries.

	Marks—1,600.
Tuberculin Test...	100
Health of Cows	100
Equipment	100
Methods...	400
Bacterial Content	800
Chemical Analysis	100
	1,600

Class B. Dairy Herd.—Ten or more cows in milk. To the winner, Challenge Cup (given by Captain Allan Skelton), and diploma. (The cup is to be won two years in succession or three years in all to become the actual property of the winner). A diploma is awarded to each competitor who, in the opinion of the judges, produces milk of a sufficiently high hygienic quality. £5, £4, £3, £2, and £1 are given in prizes, together with a certificate to milkers. The second prize will be awarded if there are three or more entries, and the third prize if five or more entries. 1,500 marks are given as in Class A., less 100 for the tuberculin test.

Herds obtaining a diploma, and at the same time having a herd that has passed the tuberculin test, are awarded a certificate to that effect, in addition to the diploma.

Champion Prize.—Howard Challenge Cup (given by H. G. Howard, Esq.). The Howard Challenge Cup is awarded to the competitor taking the highest number of marks in Class A. or B. The marks for the tuberculin test do not count for this award. The cup is to be won three years in succession before becoming the actual property of the winner.

Kent Competition.—The Kent competition attracted 53 entries, a testimony to the keen interest aroused amongst dairy

farmers in the county. Fortnightly tests of competing herds were made and surprise inspections of methods and appliances used at milking were carried out. It is especially gratifying to learn of the keenness displayed by the farm hands, but the whole progress of the competition must be a great encouragement and a matter for congratulation to all concerned. At the time of writing the full results of this competition had not come to hand.

It is hoped that similar competitions will be followed in other counties, as these local competitions are very effective in arousing interest in the subject, even among non-competing milk producers.

* * * * * *

Seed Testing in Northern Ireland.

THE Government of Northern Ireland has established an Official Seed Testing Station at Belfast for the purpose of testing the germination and purity of the principal classes of cereal, grass, clover, root and vegetable seeds, in accordance with the provisions of the Seeds Act, 1920. Enquiries as to the procedure for sending samples, the fees payable, and other relative matters, should be addressed to the Secretary, Ministry of Agriculture for Northern Ireland, Wellington Place, Belfast.

* * * * * *

Prosecution for False Application of the Trade Description "Sussex Ground Oats."

PROCEEDINGS under the Merchandise Marks Act, 1887, were recently instituted at Oldham by the Ministry of Agriculture against a firm of millers who had applied the description "Sussex Ground Oats" to an article which contained 70 per cent. of material not derived from oats. The case originated in the North Riding of Yorkshire where an official sampler took a sample of Sussex Ground Oats under the Fertilisers and Feeding Stuffs Act, which was found to be adulterated. It was considered by the Local Authority that the local trader was not to blame, and they therefore arranged with the Ministry that the consignment should be traced to its source and that the original seller should be prosecuted under the Merchandise Marks Act. The consignment was traced through the hands of merchants at Stockton, Leeds and Liverpool, and finally to the manufacturers at Oldham. The defendant pleaded guilty, but urged in mitigation that it was customary to sell mixtures as "Sussex Ground Oats," and that

they had sold them with the usual notice on the invoice that the article was the product of more than one substance or seed. The magistrates, however, took a serious view of the case and inflicted a fine of £10 and £20 costs.

* * * * * *

Importation of Potatoes into Jersey.

GROWERS and exporters of potatoes are informed that, following representations made to the Jersey Authorities by the Ministry, the regulations governing the importation of potatoes into Jersey from Great Britain and Ireland have now been modified. In future, potatoes may be imported into Jersey if grown more than one mile from land known to be infected with wart disease; previously, all potatoes grown within five miles of infected land were prohibited entry.

It will still be necessary for each consignment to be accompanied by a sworn declaration by the exporter that wart disease has not occurred on the land where the potatoes were grown, as well as by an official certificate that the disease has not occurred within one mile of such land. In the case of potatoes grown in England and Wales, applications for the necessary certificates should be sent to the Ministry, together with a remittance at the rate of 1s. for each certificate required.

* * * * * *

Results of the November Rat Week.

REPORTS are now available as to the National Rat Week held early in November last, in which the Ministry of Agriculture invited the co-operation of all Local Authorities and the general public. Five hundred and eight Local Authorities were circularised, and a large number of them took special action as requested. Other Local Authorities were known to be giving the business of rat destruction such constant attention that there was little left for them to do in Rat Week. Several Local Authorities prepared or purchased the rat poisons recommended by the Ministry, and in 17 instances issued them free of charge, and in 6 sold them at cost price. One Local Authority purchased a number of steel traps which it lent out to applicants.

In many districts Local Authorities invoked the aid of cinema proprietors, who willingly assisted in the showing of films and slides dealing with the rat menace and rat destruction. The Town Council of Leeds organised an exhibition in the Public Health Office, at which the various media for rat destruction

were placed on view and literature on the subject was distributed. In some districts the co-operation of local chemists and hardware merchants was sought, and these salesmen induced to give special window displays of poisons, traps, etc.; this method was found to supply an excellent local advertisement for the Rat Week.

Perhaps the most useful part of the work done by Local Authorities, however, was through the example set by them in clearing the large sources of infestation in the property under their care, *e.g.*, in the sewers, rubbish shoots, sewage farms. Householders, knowing of the determined attack which the Local Authorities were making in this direction, saw the usefulness of making a similar effort at the same time on their own piece of "front" against the common enemy. In 28 districts, reports show that Sanitary Inspectors made house-to-house visits and cleared the rats from infested premises as they went: in some of these "gassing" was adopted, usually with excellent results.

In regard to numbers of rats destroyed, no general statistics are available, and very few Authorities have tried to give figures. One Local Authority (Stoke-on-Trent), however, kept as careful record as possible of the numbers of rats known to have been killed during the Week; these were—859 killed by dogs and ferrets, 385 poisoned, and 241 caught or killed in other ways; a total of 1,485.

* * * * * *

Worn-out Horse Traffic.*

The following reply has been directed by Sir Robert Sanders, M.P., Minister of Agriculture, to a letter from Miss A. M. F. Cole, of the Royal Society for the Prevention of Cruelty to Animals, regarding what has been described as the worn-out horse traffic, and to a letter from the same lady of 5th March, circulated to Members of Parliament and to the Press:—

"As you are aware, the export of worn-out horses to the Continent has entirely ceased, and the Minister notes that your criticism is now directed not against the standard of fitness of the horses shipped nor the manner in which they are conveyed to the Continent, but to the fact that a few of the horses exported are purchased by butchers on the Continent for slaughter. In reply to this the Minister desires me to say that he has no control over the horses after they leave this country. His powers under the Exportation of Horses Acts are limited to ensuring that the horses shipped are in a fit condition to

travel and to work, and that the horses are conveyed to the Continent in a satisfactory manner. When it is the custom of a country eventually to slaughter its horses for food it is obviously impossible to ensure that horses exported to that country are not sooner or later slaughtered for that purpose, whatever their value or character may be at the time of exportation. To ensure, therefore, that no horses sent to the Continent are slaughtered for human food it would be necessary to stop the trade in working horses altogether, and this the Minister has no power to do, even if such a course were desirable.

In your letter of the 5th instant you refer to the landing of 95 English horses at Antwerp on 23rd October. Among these horses were a considerable number of sound young animals ranging from foals upwards, and including many ponies and cobs. The Ministry's Superintending Inspector was present with other inspectors at the landing of the whole of this consignment, and it is clear from the reports of these inspectors that they were a very fine lot of animals. You also refer to the fact that working horses are released on the quay with a working licence. This is no new procedure; a proportion of the horses landed from Great Britain have always been so released, but the fact that the proportion has largely increased in recent months proves that the animals shipped are of a much higher standard than formerly. As a matter of fact the standard required by the Minister's inspectors at the ports of embarkation is a good deal higher than that of many horses working in the streets of this country.

Notwithstanding this, a few of the animals may be purchased by butchers for slaughter. The number purchased for this purpose, however, has decreased considerably during the last eighteen months, and the traffic in horses for slaughter has been largely superseded by a traffic in carcasses of horses slaughtered in this country. For example, during January and February of 1921 the number of horses exported to Antwerp from Hull, Goole and Leith (the principal ports concerned) was 3,676. During the first two months of 1922 this number fell to 816, and during the corresponding period of this year the number was only 42. Many of these 42 were of the cob and riding class of good value, for which there is still a certain demand on the Continent, and they would not be bought for slaughter on arrival there. From the reports of the Ministry's Superintending Inspector, who pays frequent visits to the

Continent, it is clear that for some time past it has been generally unprofitable to purchase British horses for slaughter on arrival at Antwerp. This is due to the high standard of fitness required by the Ministry, the high cost of transport, and the competition of the trade in carcasses which has so largely increased during the past eighteen months.

In reply to your inquiry as to who declares the value of the horses exported, the Minister desires me to say that the values quoted by him in recent replies to Parliamentary questions are the 'declared values' recorded in the Monthly Trade and Navigation Accounts published by the Board of Trade.

Reference is made in your letter to a recent visit to Rotterdam, where you saw certain British horses in the market. I am to point out that every horse from Great Britain appearing on the market at Rotterdam must, according to Dutch regulations, have passed through the quarantine station there, where feeding and watering is compulsory. The Ministry's Inspector has found from personal inquiry that practically all such horses appearing in the Rotterdam market have been released from quarantine the same morning. The fact that one of the horses eagerly accepted some lumps of snow does not prove that the animal was parched with thirst. An offer of snow to any other animal in the market would probably have had the same result. The walking of horses some miles to a place of slaughter does not necessarily involve cruelty to the animals. Working horses of the class passed at the ports of shipment are quite fit to walk to their places of destination, although this may be more than ten miles distant.

As regards the method of slaughter in Holland, it is necessary under Dutch regulations to slaughter all animals in public abattoirs, and the method of slaughtering horses is by pole-axe or humane killer, principally the latter.

The Minister has made inquiries into the death of the two horses in a cargo of twelve shipped on the s.s. 'Roman' from Leith to Amsterdam on the 10th February. It appears that the weather remained good for about eight hours after the vessel had left Leith, and then suddenly changed, causing the vessel to labour heavily. One of the horses was taken suddenly ill and died without a struggle, the other got down in his stall and died some time later. The deaths were precipitated by sea sickness. The remaining ten horses were landed in good condition. The inspector who examined these animals before shipment states that they were all of a very good class. The

two casualties were unfortunate, but there is, of course, an element of risk in shipping live horses across the open sea whatever precautions are taken. The same risk has to be taken in regard to all classes of animals shipped. Only recently a thoroughbred mare of the value of £200 died as a result of a broken leg on a voyage to Ireland. Other horses fell on the same voyage, but were able to get up again without injury.

As regards the export of horse carcasses, I am to say that the Belgian Authorities have recently called the attention of the Ministry to the need for improvement in the packing of the carcasses, and although the Minister has no power to regulate this matter the Department has made representations to the companies engaged in the trade. I may point out, however, that out of 88,000 quarters exported to Antwerp during the year 1922, only 339 quarters were condemned. In connection with this matter the Minister in 1921 formally invited the Belgian Government to appoint their own veterinary inspectors, if they thought fit, to examine in Great Britain the horses slaughtered on this side and the carcasses intended for export for human consumption. As an alternative the Ministry offered to nominate veterinary surgeons to carry out such examinations to satisfy Belgian requirements. The Belgian Government did not, however, avail themselves of the Ministry's offer.

In conclusion, the Minister desires me to assure you that he has every sympathy with all well-directed efforts to put an end to avoidable suffering to animals. So far as the transport of horses by sea is concerned, everything possible has been done by the Ministry to ensure the comfort of the animals. The Ministry's regulations prescribe a standard to which the fittings of the vessels must conform, they prohibit the carriage of horses on unprotected parts of vessels during the winter months, and they lay down definite rules for food and water and general comfort of the horses immediately before and during shipment."

* * * * * *

Ministry's Exhibits at Agricultural Shows.

DURING the show season of 1922, 12 of the most important agricultural and horticultural shows were visited with the Ministry's exhibit. The Ministry's stand attracted a large number of visitors, inquiries were numerous and varied, and leaflets and publications to the value of £188 were sold.

Exhibits were also loaned to a number of small shows on payment of the cost of rail carriage by the Societies concerned.

From the point of view of educational value the year's work was very satisfactory, and the Ministry's exhibit would seem to have been appreciated by a large number of people.

During the coming show season it is proposed to take an exhibit to the principal shows, including the Bath and West (to be held at Swansea from May 17-22); the Royal Counties (Southampton, May 30 to June 2); the Royal Agricultural Society of England (Newcastle-on-Tyne, July 3-7); the Lincolnshire (Lincoln, July 18-20); the Royal Welsh (Welshpool, July 25-27); the Royal Lancashire (Liverpool, August 2-6); the Imperial Fruit and National Potato Show (Manchester, October 26 to November 3); the Norwich Fat Stock Show (Norwich, November 22-24); and the Birmingham Fat Stock Show (Birmingham, December 1-6).

Special exhibits relative to clean milk production and showing the results of research in fruit-growing, soils and manures, plant breeding, and silage and silos are in course of preparation, in order to give publicity to recent developments in agricultural research. Other exhibits will deal with building, insect and fungus pests, rat destruction, seed testing, small live stock, bee-keeping, and other matters.

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A Tulip and Daffodil Farm in the Isle of Wight.

WITHIN easy access of the villages of Godshill and Sandford, in the Isle of Wight, on the elevated land overlooking the "Valley of Daffodils" where these flowers grow wild, an ex-Service officer is establishing a daffodil and tulip farm. At the present time some two acres of land have been put under cultivation. The land selected slopes gently to the west and there is a fair amount of natural shelter. The soil is a medium loam with a superficial covering of sand; the subsoil is clay. It is not the kind of soil one would have selected for the purpose, but the owner appears to be making a success out of his venture and is considering immediate extension of the cultivated area, by breaking up some of the adjoining land now under grass.

Apples have been planted in rows 18 ft. apart, the trees being 21 ft. apart in the rows.

Narcissi and tulips form the bulk of the flowers grown, but a few beds of wallflowers, which were planted for trial, have given such good financial results that it is probable more of these will be grown in future.

The flower beds are slightly raised above the level of the surrounding land and are cut out in blocks of sufficient size

to accommodate about 2,000 plants, set out in rows running north to south, 8 in. apart with about 3 in. between the plants in the rows. There are generally three of the beds between each row of apple trees—2 ft. being allowed between the apple trees and the bed adjacent to them, and a 2-ft. path between each bed to facilitate picking.

The occupier, his wife and daughter do practically all the work on the "farm," the only outside help obtained being casual labour for flower picking. The little place is a model of cleanliness and good management.

The preparation of the land for bulbs is effected by taking a well-manured potato crop and constantly cultivating during the time the crop occupies the soil. The bulbs used to have a dressing of kainit after planting, but they do not now receive any manurial treatment at all. The narcissi are allowed to remain for upwards of five years; the tulips are lifted annually. The occupier tried leaving the tulips for two years, but finds the plants produce more flowers if lifted each year. He has not tried lifting his narcissi at three years, and it is probable that it would pay him to do so.

The first picking of narcissi usually commences in the first week of February; tulips are gathered from the beginning of April.

Most of the well-known commercial varieties of narcissus and tulip are grown, notable exceptions in the former being Soleil d'Or and Scilly White. Irving and Golden Spur are the earliest kinds grown. In tulips, the Darwin types are specially favoured. The popular Clara Butt is perhaps the most profitable of all the tulips grown here.

Flowers have been the mainstay of the business, but it is the intention of the owner to sell bulbs when he has sufficient stocks for this purpose. There is a good local demand for the flowers; a large number of visitors on the way to or from the "Valley of Daffodils" purchase bunches of the cultivated sorts. A few lots are sent to the northern markets, but the bulk of the business is done on the spot.

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Young Farmers' Tour in Canada.

AN account of the introduction of the Young Farmers' Club movement into this country and of the methods of organisation adopted in the early stages appeared in this *Journal* for March, 1922. Since that time considerable progress has been made. There are now 35 clubs in existence in England and Wales

with a membership of over 600, and there is every likelihood of rapid extension in the future. The *Daily Mail* maintains its interest in the movement, and the possibilities of these clubs are being increasingly recognised by breed societies and by business firms dealing in agricultural products. The Ministry regards the movement as an important form of agricultural education, and assists it by any means in its power.

The *Daily Mail* International Federation of Young Farmers' Clubs is proving a valuable means of exchange and communication between boys' and girls' agricultural clubs in the United States, Canada and England. A great impetus has now been given to this work by the generosity of the Presidents of the Canadian National Railways and the Canadian Pacific Railway, who have made arrangements for four boys and four girls, chosen from Young Farmers' Clubs over here, to pay an educational visit to Canada this summer.

The boys who have been selected have just left England, and the girls will start shortly. They will be absent for 6 months. They will visit agricultural departments, experimental farms and boys' and girls' clubs in Quebec, Ontario, Alberta, Saskatchewan, Manitoba and British Columbia, and will also profit by summer courses at Canadian colleges. The arrangements made not only provide for care and instruction but for much individual entertainment. It is evident that such an experience will have very far-reaching effects, not only on the lives of the individuals concerned but also on the relationship between young farmers in England and Canada.

Suitable candidates for the trip were chosen, in the first instance, by the clubs of which they are members. The final selection was made by an examining body representative of the Board of Education, the Ministry of Agriculture and the National Farmers' Union. The successful candidates were :—

Boys.—L. J. Grimmer (Buckland Club), T. C. White (Kingsclere Club), G. W. Salter (Hemyock Club), J. Murray (Welwyn Garden City Club).
Girls.—Joan Moore (Loughborough Club), Mildred White (Hemyock Club), Joy Townsend (Guildford Club), E. M. Absolon (Hornsey Club).

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Foot-and-Mouth Disease.—All restrictions imposed in connection with the outbreaks in Gloucestershire and Derbyshire have been withdrawn, as from 24th March and 5th April respectively.

On 3rd April a fresh outbreak of the disease occurred in Norfolk, three cattle out of 13 being found to be affected on premises at Billockly, near Acle.

A calf from the premises had been exposed in Acle market on 29th March, but so far there have been no extensions of the disease. The usual restrictions were imposed on 3rd April, and have since been modified in the outer portions of the district affected. The area under restrictions has now been reduced to approximately a five mile radius from the infected premises.

Dogs from Ireland.—The case of illness in a cat at Newcastle, Co. Down, which was diagnosed as rabies in February last, has not been followed by the discovery of any cases of rabies in dogs or other susceptible animals in Ireland, notwithstanding searching inquiries by the authorities. The County Down (Muzzling and Control of Dogs) Order of 20th February, 1923, has in consequence been revoked, and the Ministry has in the circumstances felt justified in withdrawing the restrictions imposing quarantine on dogs imported into Great Britain from Ireland. An Order to this effect was made on 21st April, and as from that date no licence is required for the landing of dogs from Ireland.

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QUESTIONS IN PARLIAMENT.

The following question was answered in the House of Commons on the 11th April:—

Relief of Rural Unemployment.—*Mr. Turton* asked the Minister of Agriculture whether he is aware that a large amount of agricultural labour has failed to be absorbed on the land; and whether, to assist such unemployment, he is prepared to continue to aid schemes for land drainage and water supply throughout the year?

Sir R. Sanders replied that he proposed to recommend a resumption in the early autumn of schemes for the relief of rural unemployment, but during the summer months there is usually little or no unemployment among agricultural workers, and it would be undesirable to set on foot schemes which might endanger the supply of labour required during the harvest months.

Agricultural Workers.—In reply to a question by Mr. Noel Buxton on 22nd March, as to the number of boards of guardians which were granting relief in aid of the wages of agricultural labourers, Mr. Chamberlain said that cases of this kind had been reported by nine boards of guardians, but that, so far as he was aware, six of these boards had subsequently ceased to grant such relief.

On 26th March, Mr. Noel Buxton asked whether, having regard to the reduction in wages of farm labourers proposed by the Farmers' Union, and to the fact that farm labourers in employment had in numerous instances to seek relief from the Poor Law, the Minister of Agriculture would set up a Committee of Inquiry on the question whether farmers on good land were justified by economic conditions in making the reductions. The Minister, in reply, said that he did not think that an inquiry of the kind suggested would be of service in the present circumstances, and pointed out that he had suggested to both sides in the Norfolk dispute that they should agree to accept the decision of an independent arbitrator appointed by the two sides jointly.

Rear-Admiral Sueter asked on 29th March whether the Prime Minister would consider the propriety of suspending the payment of subsidies for the emigration of agricultural workers until some attempt had been made to

re-establish the prosperity of agriculture at home. Mr. Baldwin replied that under the Empire Settlement Act no special inducements were offered to agricultural labourers, and although many of the emigrants drawn from urban districts had had some agricultural experience, he understood that very few, if any, regular agricultural workers had taken advantage of the facilities offered.

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REPLIES TO CORRESPONDENTS.

Chinese Method of Corn Growing.—H S. enclosed a newspaper cutting referring to the "Chinese" method of corn growing as practised in Latvia and asked for information.

Reply: A reference to the "Chinese" method will be found on page 740 of this *Journal* for December, 1909, in a note on a "Russian Method of Corn Growing." The method (it is there stated) "which broadly speaking, depends on the careful cultivation of the individual plant, is not new, as it has often been proposed in the past in this country and constitutes the ordinary practice in China at the present day. The large amount of labour required makes it inapplicable for ordinary corn growing except in countries where labour is very cheap and very plentiful." The main principle is to sow in rows and then after the corn has grown a little to earth it up. The cutting enclosed refers only to the sowing in rows. This practice, combined with repeated earthings up, is traced by a writer in the Spanish Official Boletin de Agricultura for September last to a Chinese Imperial Edict of 1762 B.C. It should be added that the same writer ascribes the renewed interest, in Western agriculturist countries, to the method of sowing in rows to the English Jethro Tull (1674–1740 A.D.).

Eradication of the Lesser Celandine (*Ranunculus Ficaria*).—J.R. asks whether spraying is effective.

Reply: The Ministry has no records of experiments in the use of sprays for control of this weed. Celandine is one of the most difficult of all weeds to eradicate from grass or cultivated ground. It is increased by seeds, and by tubers produced in small clusters an inch or two below ground. The tubers are very easily separated from the parent plant and in digging up the plants there are left in the ground many tubers which produce a fresh crop of plants the following year. The only known method of thoroughly clearing infested ground is to dig up carefully and pick out as many as possible of the plants and tubers, and then keep the ground well worked during summer in order to kill all seedlings. The following spring the ground must be worked very early in order to destroy young plants as they appear, continuing the working until the end of April. The ground should then be cropped by a heavy foliaged crop that may be expected to kill any seedlings that may appear. It is probable that several years may elapse before the ground is thoroughly clean. Thorough and constant working is the most effectual remedy.

Taro.—K.P. asks whether this could be cultivated in England.

Reply: Full particulars of Taro (*Colocasia antiquorum*) are given in the Kew Bulletin, Additional Series, IX (4) p. 755. The yield is from 5,000 to 13,000 lb. of tubers per acre. As, however, it is a tropical plant it could not be grown in the open in this country.

Nauru Phosphate.—L.O. asks for analysis.

Reply: In analyses of 11 typical samples of Nauru Phosphates by Thomas Steel in the *Journal of the Society of Chemical Industry*, Vol. XL. p. 59 T., the

P_2O_5 content varies between 37·57 and 40·44. Only traces of iron or alumina were present in any of the samples and no figures are given. Moisture content was estimated at a temperature of 200° C.

An analysis of Makatea Island Phosphate in Collins' "Chemical Fertilisers," pp. 36 and 37, gives P_2O_5 content at 38·24 and oxide of iron and alumina (taken together) at 1·01. Makatea phosphate is said to bear a very strong resemblance to Nauru.

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NOTICES OF BOOKS.

The Productivity of Hill Farming.—(J. Pryse Howell. London: Oxford University Press. 23 pp. Price 1s.) In the spring of 1918 the Food Production Department decided to conduct an inquiry in connection with sheep-farming in England, Wales and Scotland, the particular object being to collect information in regard to the following points:—

(*a*) Yield of mutton, wool, beef, etc.;
(*b*) Management and quality of the stock;
(*c*) Extent to which bracken, gorse and heather affect the value of the grazing;
(*d*) Possibility of improving hill ground by manuring and drainage, and of growing more winter keep;
(*e*) The need for shelter.

The inquiry was entrusted to Messrs. J. C. Robertson, Fodderty, Dingwall, Scotland (since deceased), C. Bryner Jones, Welsh Secretary to the Ministry of Agriculture, and J. Pryse Howell, now of the Institute of Research in Agricultural Economics, Oxford. A tour was arranged embracing some of the best known and most typical sheep districts in the west and north of England and in Wales. The inquiry commenced on 10th April and was completed on 10th May.

The report now issued gives the statistical results of the inquiry and makes a number of recommendations for the improvement of hill pastures, the most important being (1) a systematic inquiry into the diseases affecting sheep; (2) the burning of heather, gorse and grasses; (3) the more effective control of rams on unenclosed sheep walks; and (4) more efficient management of "commons." The provision of fencing as a means of controlling the stocking and grazing, the planting of timber to afford shelter, and increased attention to drainage and manuring are other measures suggested for increasing the productivity of these areas.

The Soybean.—(Chas. V. Piper, M.S., D.S., and Wm. J. Moore, B.S.A. McGraw Hill Publishing Co., Ltd., Bouverie St., London, E.C.4. 1923. 329pp. Price 20s. net.) Attention has been called from time to time in this *Journal* to the value of the soy (or soya) bean as a food for stock, whether in the form of cake or meal or as a forage crop, and it may be recalled that attempts were made to introduce the cultivation of the plant into this country in 1909, when some seeds obtained from North Japan were experimentally grown at the Midland Agricultural College and at the Cambridge University Farm, with unsatisfactory results which were repeated in further trials in the following year with seeds obtained from Manchuria.

In America, however, the soybean has been successfully acclimatized, and according to official estimates 170,000 acres were grown in the United States

in 1920 for seed production, while it is estimated that not less than four times that area was grown for forage, pasture and ensilage. The high yielding capacity of the bean and the ease and cheapness of harvesting the seed, in both of which respects it excels other legumes, while sharing with the latter the favourable effect on the succeeding crop, leave little doubt that it is destined to become one of the major field crops in American agriculture, especially in the Corn Belt area, where it is expected largely to replace oats in the rotations. It was, therefore, eminently desirable to bring together in a single volume the accumulated information concerning this crop, and a glance at the very comprehensive bibliography (wrongly included under the final chapter heading) of the admirable work now issued under the joint authorship of the Agrostologist and Agronomist to the U.S. Department of Agriculture is sufficient to indicate the extent and diversity of the scattered literature in the subject.

It must be said that the authors have performed their task thoroughly. The introductory chapters, dealing with the botanical and agricultural history of the plant and its commercial status, are followed by detailed directions for its culture, harvesting and storage. Tabular analyses are given showing the nutritive constituents of the plant—and it is interesting to note that in the important factor of vitamine content the soybean is stated to be the only seed so far as is known at present, with the possible exception of flax and millet, containing sufficient amounts of both the water-soluble and the fat-soluble vitamines for the promotion of proper growth. Succeeding sections classify the various uses of the soybean and its products both for human and animal food and for other purposes (such as the use of the oil in soap and paint manufacture), with full information as to methods of utilization, including numerous recipes for the preparation of palatable and nourishing table dishes. The final chapter discusses the enemies of the soybean, but it is satisfactory to learn that no pest has assumed any great economic importance in connection with its culture in America, and that the soybean would seem to be less affected by destructive diseases and insects than are most other forage or food plants.

Allusion has been made above to the very extensive bibliography cited by the authors. It remains to be added that the book is provided with an excellent index and is admirably printed and illustrated. Altogether the work must be welcomed as a valuable contribution to agricultural literature.

Experiments with Oats, 1922.—(University College, Bangor.) In continuation of a series of experiments conducted over a series of years, seventeen varieties of oats were grown in 1922 at the farm of the University College of North Wales, on land which had been cropped with mangolds in the previous year.

As black and yellow oats are extensively grown in North Wales, some of these have been included in the trials every year. On the whole they have not done so well as the best of the white varieties, but it is pointed out that the conditions of the College farm are hardly typical of those under which black and yellow varieties are mainly grown. The fact that many enterprising farmers who have tried white varieties still continue to grow the others is evidence that for comparatively poor soils, and particularly for upland districts of high rainfall, they have a special value.

Of the white varieties tested, "Victory" and "Record" have on the whole proved their superiority, taking into account all the desirable qualities of oats.

"Record" has the stronger straw and is therefore better able to withstand wet seasons, but for drier soils and districts "Victory" is probably the better of the two. Good results were also obtained from "Crown" and "Wide Awake." Potato oats have given good yields of straw, but comparatively little grain.

Of the black varieties tested, "Black Tartarian" continues to hold its own Two yellow varieties, "Golden Rain" and "Goldfinder," proved remarkably similar in every respect but one, that of earliness of ripening, in which the former has always been one of the first while Goldfinder is one of the last. In view of the risk of damage to the crop from delayed harvest, farmers are recommended therefore to husband the Golden Rain—which, by the way, is one of the new varieties produced by the Swedish Seed Institute at Svalof.

The Effect of Silage on the Flavour and Odour of Milk.—(U.S. Dept. of Agri., Bull. No. 1077, Sept., 1922.) This bulletin is a report of an investigation carried out on the Dairy Experiment Farm of the U.S. Department of Agriculture, to determine whether or not the feeding of the different silages affects the flavour and odour of milk, and, if so, how these silages may be so fed and the milk so handled as to minimise their effect on the quality of the produce.

The results obtained confirm the observations made by other investigators that there is a wide variation in the flavour and odour of the milk from individual normal cows receiving the same feeds. While silage-tainted barn air may have some effect on the flavour and odour of the milk, it is of relatively small importance under average and even under extreme conditions. The flavour and odour of silage are largely imparted to milk through the body of the cow. Silage which is fed one hour before milking is so quickly absorbed that its taint is discernible in the milk, it should therefore be fed immediately after milking.

It was found that legume silage affected the flavour and odour of the milk to a greater degree than an equal amount of corn silage. Moderate quantities (15-25 lb.) of corn silage fed after milking, and prompt aeration of the milk, may in some cases actually improve the flavour of milk that would otherwise have a flat or insipid taste.

American Progress on Wart Disease Investigations.—The January Number of "Photopathology" contained an abstract of a paper by Freeman Weiss and C. R. Orton on their investigations into the Wart Disease of Potatoes. Apparently the American season during 1921 was similar in many respects to that experienced in this country; the weather being particularly dry and the temperature hot, under which conditions Wart Disease behaved exactly as it did in this country, giving only slight infection even to susceptible varieties. The American investigators have apparently not been able to associate the retarding of the fungus specifically to either of these factors, though in this country it has been fairly proved that retardation is influenced by soil moisture.

The American investigators are testing most varieties of potatoes for immunity on lines similar to those adopted by this country at Ormskirk, and as the result of the 1921 test they are able to class seven additional varieties as immune, making thirty-four in all out of the one hundred and three varieties tested.

The investigators have continued their experiments in testing host plants other than the potato, including the Tomato, the Egg plant, Peppers, Petunia

and Tobacco, but have nothing further to record on this matter than was published the previous year, namely, that the Potato and the Tomato remain the only demonstrative American host plants.

International Agricultural Congress.—The Organization Commission of the Eleventh International Agricultural Congress has drawn up the programme for the Congress, which will be held at Paris from the 22nd to the 26th May next. The Congress will be divided into seven sections:—1. Agronomy (application of sciences to agriculture, agricultural improvements, international war against parasites and diseases of animals, improvement of plants); 2. Influence of Agriculture on international relations; 3. Rural Economy (agricultural credit, co-operation and insurance, agricultural instruction); 4. Live Stock; 5. Viti-culture; 6. Silviculture; and 7. Agriculture of Warm Countries.

The Congress will be composed of official delegates of the governments and of public establishments and associations exclusively agricultural (agricultural societies, syndicates, co-operative societies, etc.) The subscription for each member is fixed at 25 francs.

Communications concerning the Congress should be addressed to The Secretary-General, Mr. Henry Sagnier, at the Office of the Organization Commission, 18, Rue de Bellechasse, Paris.—(*From La Renaissance Agricole, 25th February*, 1923).

The Making of Rural Europe.—(By Miss Helen Douglas Irvine. London: Allen & Unwin. Price 7s. 6d.) The History of Rural England has been written by a master hand in "English Farming Past and Present." In "The Making of Rural Europe" Miss Helen Douglas Irvine attempts the same task for Europe generally. The book is necessarily a summary, but the fascination of the story is as great as we find it in Lord Ernle's classic. The secular struggle between the peasant and his overlord which has its roots in a primeval and ever-present land hunger has profoundly affected the history of all lands. In England we have escaped the latest turn of the wheel—the Green Rising, which, as Mr. G. K. Chesterton, in his preface to Miss Irvine's book tells us, is "a thing like the Great War—a vast victory for the peasants, and therefore a vast defeat both for the communists and the capitalists." In effect, this Green Rising on the Continent of Europe has meant an addition by revolutionary methods to the area of land held by peasant proprietors, a class more numerous abroad than in England.

The greater part, however, of "The Making of Rural Europe" is concerned with peaceful developments. It shows, how, as in England, the mediæval servile tenure of villeinage gradually developed in Europe generally into either proprietorship or leasehold. In the words of Sir Henry Maine's famous epigram, it illustrates the transition of land tenancy from "status to contract." It is remarkable to learn that this change set in earlier, and was more complete, in England than in any other European country. "England" says Miss Irvine, "was endowed with shrewdly planned political institutions . . . they were particular in the binding force they gave to the written word," whether that word was inscribed in a lease or in the rolls of the manorial court: there was nothing on the Continent comparable with our "copyhold" tenant. The early, and eventually predominant, hold which industrialism obtained in England was also an operating cause, as well as the development of (to use

Miss Irvine's happy expression) "tentacular" towns with their fatal attractions for countrymen.

Miss Irvine has much to say regarding the métayer tenure which is still a prominent feature of rural polity in the south of France and Italy. Whereas in the north and east of Europe customary tenure was followed by lease for a fixed annual rent, in the south of France, in Italy and in Spain, the tenant has more often rendered a determined share of the produce (generally a half) to his landlord. A distinguishing feature of this tenure has also been that the stock of the farm is the landlord's property and ceded with the land. Miss Irvine's conclusion is that, on the whole, the métayers of Europe have enjoyed more security of tenure than the tenants who pay a money rent. They, with the small owners, have preserved the family institutions which are still the foundation of Continental rural society.

At the present time small holders occupy 60 per cent. of the arable and meadow land of France, and there are few countries in Europe in which the proportion of peasant farmers is less. It is not the least of the difficulties of establishing smallholders in this country "that the weather is uncertain and the standard of living unusually high." Modern industrial developments have also affected the smallholders' position by weakening the communal life of the village. The stability of the smallholder has always been greater when he could practise a lucrative rural industry as an additional means of support.

The main interest of Miss Irvine's book to the ordinary reader, however, is in the light thrown on the conditions to which the exceptional position of England is due. From the beginning of the eighteenth century, the history of English farming became exceptional. From that date and with the development of America, the Atlantic displaced the Mediterranean as the waterway of commerce. As a result of trade and industrial expansion following invention, vast wealth accrued in England. Farming became almost wholly a capitalist industry, whereas in other countries it is mainly controlled by small producers. As a necessary consequence came the inclosures policy of 1750-1850, and with it the creation of the landless labourer and the increase of paupers.

One of the most interesting chapters of the book deals with the wage-earning labourer. The co-existence of large and small farmers does not necessarily create a class of hired labourers, for the smallholders may be bound to supply labour as a customary incident of their tenure. In the 14th century attempts were made to fix the conditions and pay of labourers by statute both in England and France. The wage-earning labouring class in England was created by the absorption of small holdings into large capitalist farm. The rise of town dwellers in 1860-1900 was from 45 to 68 per cent. in England: from 29 to 41 per cent. in France: and from 34 to 48 per cent. in the whole of western Europe. In England, now, practically the whole of the rural labouring class are wage earners—and the *day* labourers are nowhere important.

The concluding sentence of this extremely interesting work may be quoted, "From villein to customary tenant and from customary tenant to contractual tenant and small owner, he (the peasant) has evolved steadily, and, except in England, has kept his place through much adversity. It is

fantastic to suppose that he can be driven out exactly when he has attained to unprecedented political and economic power." The "Making of Rural England" can be confidently recommended to all interested in the land question, the present position of which as well as its historic development in all the leading countries of Europe is traced and suggestively described with great literary skill.

Pigs and their Management.—(H. W. Potts, F.C.S., F.L.S. Australia: August Robertson, Ltd., 89, Castlereagh Street, Sydney, 1923. 282 pp. Price 12s. 6d.) The value of the pig as (in the words of an old chronicler) "the husbandman's best scavenger and the housewife's most wholesome sink" has long been recognised, but it is doubtful whether the raising of this most profitable and most prolific of farm animals has ever received the attention it deserves from farmers and stock breeders in this country. Evidence of the increasing recognition of the importance of pork and bacon production in the Antipodes, both for local consumption and for export, is afforded by the issue of the fourth edition of the excellent book on Pigs and their Management, by the ex-Principal of the Hawkesbury Agricultural College, New South Wales. This book was originally issued about a dozen years ago under the auspices of the Department of Agriculture at Sydney, and the present revised and enlarged edition embodies the results of researches carried out since that date, as well as conclusions drawn from records of successful practice in this and other countries.

Separate chapters are devoted to the discussion of the points of the various breeds, of which it is interesting to note that five of the six recommended as most suitable to Australian conditions are of British origin. Breeding, housing, feeding, sanitation, diseases and parasites, etc., are dealt with, and directions are given for the cultivation of the principal fodder crops and their proper mixture in the diet. The final chapters deal with slaughtering and bacon curing. An index is added, followed by 32 pages of illustrations, of which the first two are reproduced from this *Journal*.

Food:—[Sir Charles Fielding, K.B.E. (Agricola). London: Hurst and Blackett, 1923. 255 pp., 12s. 6d. net.] Writing with the desire to give "a comprehensive view of the whole facts bearing upon English agriculture from the point of view of the Nation at large and the Towndweller in particular," the author, drawing upon a wide study of his subject, advances a mass of interesting facts and figures in support of his contention that this country could produce practically the whole of its food requirements, on which £500,000,000 was spent abroad in 1921, and that its economic future is dependant on the achievement of this end. He refrains from urging any particular line of political policy, confining himself to stating the facts of the existing situation and suggesting the general lines on which agriculture in this country could be improved and intensified, in the assurance, which is echoed by Viscount Milner in a brief preface, that the final solution of the problem lies in an enlightened public opinion, and in the realisation by the urban majority of the nation that their own vital interests are bound up in the maintenance of a prosperous and progressive rural industry. Although the volume is addressed primarily to the townsman, the agriculturist, while he may not agree with all the author's conclusions and suggestions, will find in it much that is of interest and value.

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous.

Researches on the Efficacy of Deep Tillage and on the Distribution of the Roots of Certain Plants in Different Strata of Soil. (I.I.A. Int. Rev. Sci. & Prac. Agric., August, 1922, No. 805.) [63.196.]

Continuous Cropping or Farming on Factory Lines, *T. Wibberley.* (Hunter's List of Agr. Seeds, 1923, pp. 71-73.) [63.191.]

Economic Manuring, *F. E. Corrie.* (Hunter's List of Agr. Seeds, 1923, pp. 74-85.) [63.16(04).]

Agricultural Education in Scotland, *A. M'Callum.* (Scot. Jour. Agr. Vol. VI, No. 1, January, 1923.) [37(41).]

The Rowett Research Institute, *J. B. Orr.* (Scot. Jour. Agr., Vol. VI, No. 1, January, 1923.) [37(072).]

Rothamsted and Agricultural Science, *Sir John Russell.* (Nature, 7th April, 1923, pp. 466-470.) [37(072).]

Experiments on the Use of Artificial Light on the Growth of Plants in Germany. (I.I.A. Int. Rev. Sci. & Prac. Agr., August, 1922, No. 814.) [58.11.]

Forcing the Germination of Freshly Harvested Wheat and Other Cereals, *G. T. Harrington.* (Jour. Agr. Res., XXIII, No. 2, January, 1923, pp. 79-100.) [58.11; 63.1951.]

Wheat Breeding, *R. H. Biffen.* (Essex Farmers' Union Yr. Bk., 1923, pp. 223-231.) [576.4.]

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Field Crops.

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